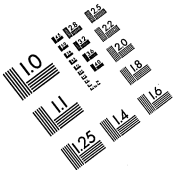
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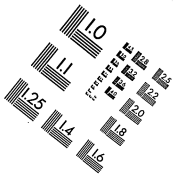
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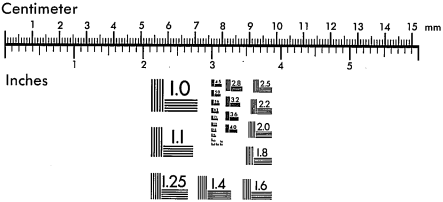
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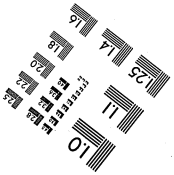
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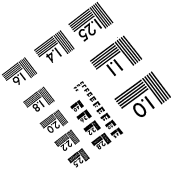
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Thomas A Edison Papers

A SELECTIVE MICROFILM EDITION

PART I
(1850-1878)

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Frederick, Maryland
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3

START

PUBLICATION AND MICROFILM
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A Note on the Sources

The pages which were microfilmed for this collection are in generally good condition in the original. There are some pages, however, which due to age are lighter than normal. Additionally, because some volumes are very large and have been bound tightly and cannot be unbound, there are intermittent occurrences of slight distortion of the edges of a small percentage of the pages. We have made every technical effort to ensure complete legibility of each and every page.

NOTEBOOK SERIES, 1867–1878

The technical records of Edison's laboratories and shops were kept in a variety of ways throughout the inventor's career, particularly during the years before 1878. The earliest drawings and notes at the Edison National Historic Site are contained in Edison's pocket notebooks. These pocket-sized books were also used extensively during the 1870s by Edison and his staff as account books and several of the books contain a mixture of both financial and technical material. (Those pocket notebooks which are exclusively financial have been filmed in the Accounts Series.)

A pocket notebook in which Edison entered specifications and drawings for printing telegraph apparatus in October 1870 concludes with the note: "all new inventions I will here after keep a full record." This determination to keep a "full record" of his inventive activity led to the creation of at least four ledger-sized volumes - the "Newark Shop Notebooks" - which were begun in late July and early August of 1871. Most of the early entries in these books are signed and dated by Edison, and the names of his father, Samuel, and his business associate, Joseph Murray, frequently appear as witnesses. The entries in the Newark Shop Notebooks continue through March 1872. Three of the four books also contain entries for the period April 1874–September 1875.

A second set of notebooks, which Edison called the "Experimental Researches," was begun in October 1875. The six numbered volumes in this series cover the period October 1875–March 1879 and contain both original entries and notes, drawings, and patent caveats that were copied from other notebooks and from unbound pages.

Other notebooks of varying sizes were also used to keep the records of the laboratories and shops at Newark and Menlo Park. Fifteen such books, covering the years 1870–1880, have been organized under the title "Miscellaneous Shop and Laboratory Notebooks." Some of these are books of original entry, while others are scrapbooks containing a mixture of experimental notes and drawings, production drawings, patent specifications, and, occasionally, newspaper and journal clippings. Two of the volumes (Cat. 1170 and Cat. 1171), covering the years 1873–1877, are labeled "Experimental Researches," but they are not part of the numbered set of "Experimental Researches" discussed above.

After Edison's move to Menlo Park in 1876, he and his staff began using soft-cover tablet notebooks to record their experiments. They subsequently removed the individual pages from the notebooks so that material relating to the same subjects could be gathered together and so that tracings could be made. A set of eleven unbound volumes ("Unbound Notebooks, Volumes 8–18") was created by Edison and his associates from the pages of these notebooks and from various other loose pages. Page and volume numbers were written on the back of each page, possibly in 1880 when many of the drawings and notes from this set were removed for use as exhibits in the Telephone Interferences (see Litigation Series).

Other notebooks at the Edison National Historic Site may at one time have been considered part of this series. For example, one bound notebook (Laboratory Notebook, Cat. 1175) contains faint pencilled page/volume numbers similar to those in Unbound Notebooks, Volumes 8-18.

Not all of Edison's loose notes and drawings were pasted into scrapbooks or assigned page/volume numbers. The Edison National Historic Site holds hundreds of pages of unbound technical material for the period 1873-1878. This material has been collected together and organized under the title "Unbound Notes and Drawings." The documents have been arranged by year and, within each year, they have been subdivided into subject categories such as "telegraph," "phonograph," and "telephone." Among the material in this series is a set of notes and drafts for a proposed book or series of essays by Edison on telegraphy and related electrical subjects (NS-74-002).

The notebooks and unbound notes and drawings that were generated prior to 1875 relate primarily to telegraphy. Later material includes notes and drawings relating to the electric light, the phonograph, the telephone, the electromotograph, the electric pen, etheric force, ore mining, batteries, and various electrical and chemical topics. Most of these notes and drawings are by Edison and Charles Batchelor, although much of the material on the acoustic telegraph and telephone is by James Adams and by Edison's nephew, Charles P. Edison.

Documents relating to Edison's technical work can also be found in other series on the microfilm. Reproductions of drawings no longer at the Edison National Historic Site are part of the legal records presented in the Litigation Series. The documents in the Litigation Series also include testimony by Edison, his associates, and his rivals, which provides valuable information about Edison's inventive activities. A few notes and drawings can also be found in the Miscellaneous Scrapbook Series. The scrapbooks in the Miscellaneous Scrapbook Series and in the Menlo Park Scrapbook Series contain newspaper and journal clippings that provide a useful context for Edison's work. Caveats, patent applications, and other patent-related material can be found in the Patent Series.

The documents in the Notebook Series have been filmed in the following order:

(1)	Newark Shop Notebooks, 1871-1875	four notebooks
(2)	Experimental Researches, 1875-1879	five notebooks [Vol. 3 is missing]
(3)	Unbound Notebooks, Vols. 8-18, 1875-1879	eleven unbound notebooks
(4)	Miscellaneous Shop and Laboratory Notebooks, 1870-1880	fifteen notebooks and scrapbooks
(5)	Pocket Notebooks, 1867-1875	thirteen notebooks
(6)	Unbound Notes and Drawings, 1873-1878	thirty folders

NEWARK SHOP NOTEBOOKS

The four books in this series were all begun in 1871 and were initially intended to serve as a "record of ideas" about telegraph devices. They cover the periods July 1871-March 1872 and April 1874-September 1875. The early entries are by Edison; later entries are by Edison and Charles Batchelor. The notes and drawings deal with telegraphy, the electric pen, and the electromotograph. The following books comprise this series:

Cat. 1174	Bound notebook (1871-1872, 1874, 1875)
Cat. 1182	Unbound notebook (1871-1872, 1875)
Cat. 1172	Bound notebook (1871-1872, 1874-1875)
Cat. 1181	Unbound notebook (1871-1872)

Newark Shop Notebook, Cat. 1174

This notebook covers the period July 1871-March 1872, with a few entries for 1874 and 1875. The majority of the notes and drawings are in Edison's hand and deal with the development of printing telegraphy. Some notes also describe experiments with chemicals for the electromotograph. Edison signed and dated most of the entries. The names of Joseph Murray and Samuel Edison frequently appear as witnesses. The front cover is labeled "Vol 6." The book contains 298 numbered pages.

Blank pages not filmed: 70-73, 76-151, 158-183, 186-235, 237-298.

E-1678 Contd
July 28, 1871 -
Feb. 18, 1873;
Jan. 8, 1875

Vol 6

1871 - 1872

Contents

Stock Quotation Printer Page 2. 3. 4. 6 115
28. 37. 66

Universal Private Line Printer Page 5. 7. 8. 9. 10
295 36. 38 to 66 to 70. 236

Electro Monograph P 157-3-4-5 x 6

Cat. 1171

E-1678 1

Newark N.J. July 28. 1871

Record of ideas and inventions relating to Printing Telegraphs Which work with a Type wheel, all of which I am under Contract with the Gold & Stock Telegraph Co of N.Y. to give them subject to the Conditions of the Contract within the next Five years from the date of Contract Reserving for myself any ideas contained in this book which I do not see fit to give said G & Stock Telegraph.

This will be a daily record, containing ideas previously formed some of which have been tried some that have been sketched and described, and some that have Never been sketched tried or described

July 28. 1871. ~~Lower Stock~~ Electro Dynamic Power

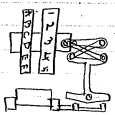


Fig 1

Double link motion for a shifting Type wheel, description unnecessary

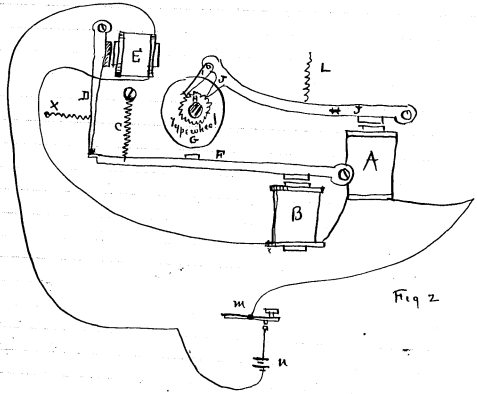


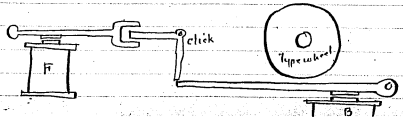
Fig 2

Printing Telegraph – to work upon one wire = The difference between this and most of the Printing Machines hitherto invented is the printing of the letter by the spring instead of the magnet as it is usually done, and preventing the printing lever from responding to the pulsations which rotate the Type wheel, by causing a lever of a seperate magnet to lock the printing lever when the pulsations are of any degree of rapidity. by referring to Fig 2 the principle upon which this printer work will easily be seen and will need but a few words of Explanation =

Having found in the Course of my numerous experiments that when a magnets armature is adjusted so close to the face of the core that it nearly touches that a current

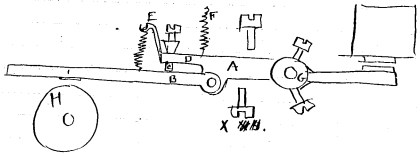
passed through it intermitted slowly it will stick or hug the core notwithstanding a considerable tension on a reacting spring. I have combined one of these magnets, adjusted in this manner with a printing lever arranged to print by a spring. E is the magnet which I will call the "Residual Relay" D is the armature lever X the reacting or adjusting spring B is the printing Magnet A the Type wheel rotating magnet, all these magnets are in one circuit in which is also the Key M or any intermitting Current device & the battery N. I is the Escapement lever H the ratchet G the Type wheel,

Now when the Current is sent through All the magnets The Magnet B pulls the printing lever F away from the Type wheel, the Magnet E pulls the lever D towards its core and the End of the lever locks the printing lever and the Magnet A rotates the type wheel, if now the key is opened quickly & closed quickly the magnet A keeps rotating the Type wheel, but the lever of the Magnet E does not respond to these intermissions, consequently the printing lever remains locked if now we wish to print we open the key for a moment Cut off all the Circuit from the Line, the Magnet E has time to discharge, The Spring X pulls the arm D back releases the printing lever, and the Spring C pulls it up and effects the printing, if the Current is now closed the lock action again takes place, and the Current can again be intermitted, the Type wheel rotated, without effecting the Printing lever. In practice I think it will be necessary to have a seperate clutch, click or lever to lock the ~~Type~~ Printing Magnet, and Knocking it out and in by the lever D, which will have dead play enough to acquire a Momentum, and Knock the clutch out, Thus

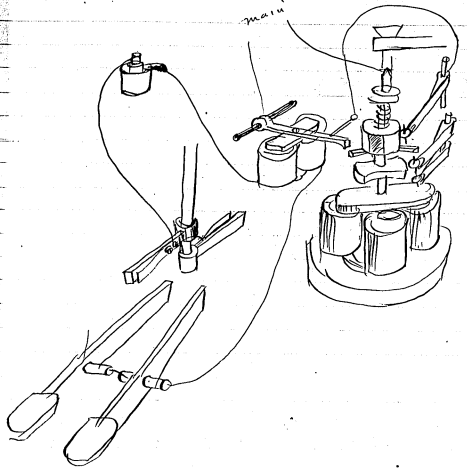


All foregoing written & drawn July 25 1871

Witness for T. Murray T. A. Edison



Jointed Printing Lever. The object of jointing the Printing Lever is to dispense with the device I have now on my universal Printing Telegraph Machine, which consists of an electrical Cam and throw over. When the Type wheel is suddenly arrested and the Current through the Printing Lever Magnet closed the A piece springs forward and the arm D & screw C kept in contact with the springy impression lever B by the spring E brings that forward, at the moment that the piece A is suddenly arrested by the screw X. the lever B springs forward by its momentum and impresses a letter and flies back till it comes in contact with the Screw C. When the Current is opened in the Printing Magnet all the devices fly back. It is obvious that the printing lever made in this manner will impress a letter instantly & fly back out of the path of the type wheel leaving it free to start of.

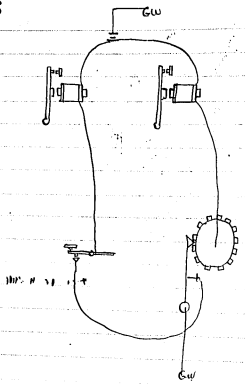


Device for arresting the rotation of the break wheel on my Universal Pta Machine by a Magnet instead of mechanically, a Description Unnecessary

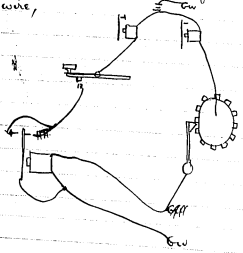
All previous

Written Aug 25 1871

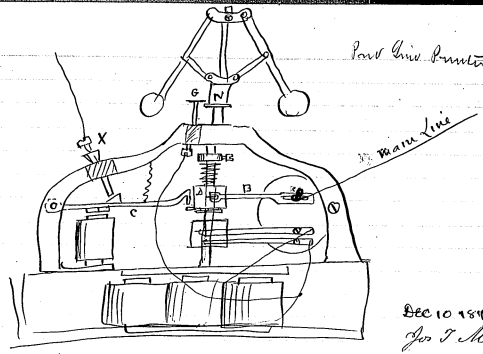
Witness for T. Murray T. A. Edison



Improvement in hand Transmitters, and their appliances, whereby The Second or Printing Circuit Cannot be closed by the key until The break wheel & point are on an open circuit =
The Sketch will explain itself, This appliance may be used with one wire,



Another Device to produce the same thing —



Dec 10 1881
Jos T Murray

Electric Pulsator for Printing & other Telegraphs & adopted on my universal Printing Machine,

The point X is insulated, and to it is connected the main Line. B is the break spring also Connected to The Main Line, when the armature Lever C, is up against the point X the frame & break wheel D is connected to the main Line So that when the Engine shaft revolves the wheel is carried around and at every revolution 2 breaks are made, but if now the armature lever C is drawn down by the magnet the Main Circuit is broken and the Wheel D arrested,

G is a screw mounted and having a disk on top Which disk rubs on another disk on the Governor slide when the Engine has reached a certain speed The disk G being Connected to the Engine magnets The current is cut off when the Governor brings the slide N up to the disk of G, or the current may be closed altogether & the magnet used to retard the motion and effect the regulation

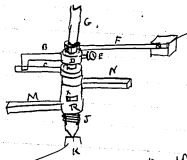
quickly or the Engine Current Can be cut or broken entirely

I do not wish to confine myself to using a disk as in G as the a lever might be used = or any governor, but I prefer this Governor as it is both electrical & frictional

Neither do I wish to confine myself to using a magnet whose lever opens the main circuit before it arrests the Break wheel thus insuring against a failure to arrest Said break wheel and prevent an extra break being made, as the magnet may be dispensed with and the same arrangement used as described in my Application for patent for my Universal Machine & the main line break attachment used,

I will mention here that the break wheel is ground with platina & the little wheels of the break springs are of Copper – also that I provide a Brush rubbing Continuously on these break wheels to keep the Oxydized matter off and keep wheel clean to insure Correct breaks

Following is arrangement on the type wheel shaft which brushes the path of the finger keys and is used for arresting type wheel & closing circuit of the arresting magnet on the Engine, and preventing further breaks being sent.



Dec 10 1871

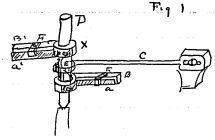
Jos T. Murray

G shaft D collar mounted F continuous rubbing

spring for bringing current to D & spring B. R is Collar with 2 arms N & M. has slot X with a stop pin in it connected to shaft to prevent the sleeve going to far around when arrested by a key. C is a spring on collar R. J is a spiral to return sleeve to original position before arrested by key. K is a Cluster in which shaft G works, The Collar R being connected to other end wire when a key is depressed and the arm say N comes in Contact with end of key while shaft is in motion the sleeve is slightly turned around into a distance governed by the pin in slot X; bringing the point B & C in Contact & closing the circuit =

following is another device,

Fig 1



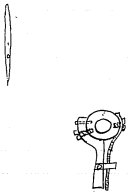


Fig 2

Dec 12 1871

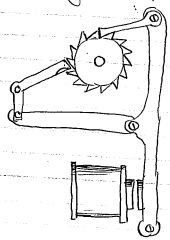
Jos T. Murray

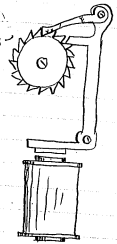
D is the shaft X a long Collar of insulating material with 3 Raised Collars on it the middle one having a brass ring on it and a wire leading from said ring to the two Connecting springs a a'; C is a spring for carrying Current to Collar and springs a a' B B' are and behind these springs to as to ensure the arresting of the shaft should the springs and key fail to make a good electrical Connection, F F' are Bridges. Connected to the arms B B'

to prevent the spring from coming out too far from the arm when the proper tension is placed on them,

Fig 2 shows how the arms and springs are secured to the rubber flanges,

Escapement for Printing Telegraphs.





Dec 12 1871
Jos T Murray

Devices for a two wheel printing Telegraph, figures and fraction wheel & letter wheel, and preventing one from printing while the other is. The principle is that the rim of the wheels are divided in 3 segments, and these segments have a space between them clear of about the distance of a space between the letter these segments are radiated out from the center to their full size, and then drawn in to a smaller size wheel, by the action of the printing levers, when ~~one is~~ the segments of one wheel is swelled or radiated out to its limits the segments of the other is drawn inward thus increasing the diameter of one and increasing that of the other

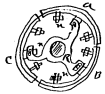


Fig 1

Fig 2

Dec 19 1871
Jos T Murray

a b c segments n n n studs on flange wheel with pins from segments sliding in them to guide segments. R arms with crooked slots as fig 2 for giving outward or inward motion to segments

Fig 3

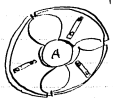
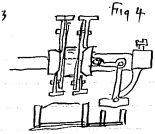
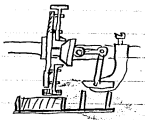
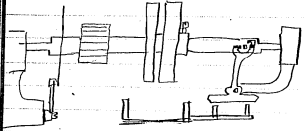


Fig 4





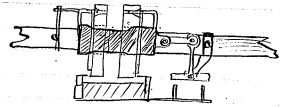


Dec 19 1871

Jno T Mercury

Shifting shaft

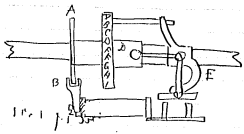
I piece stationary
Ratchet rotating shaft,



Dec 24 1871

Jno T Mercury

Loose type wheels with an inclined slide alone so that when shifted one wheel is made rigid while the other is loose. each wheel is provided with a flange (a) the Printing lever has two springs [flat] on each side so that when Ply lever comes up to Print the springs touch both wheels. but one being rigid bows spring down while other being loose the spring throws it up and keeps it away from paper =



The above drawing is a sketch of my locking device, The object of which is to place a number of my Universal Stock Printers on one circuit or circuits, and lock or unlock any one or any number from a central station upon that circuit, I will copy here a caveat which I have previously prepared =

" The object of this invention is to prevent any printing instrument among a number in the same circuit from Printing, all or any of them.

" The invention consists of an attachment to one of my Universal Stock Printers which work upon one or two wires according to the circuit devices used - The attachment is throwing the lock wheel by means of the shifting devices into a forked lock piece attached to the Printing Lever, which piece acts as a lock to the type wheel and also as a block or impedement to the bringing of the Printing Lever to the face of the type wheel and making an impression, The fraction wheel I have dispensed with, and use the shifting devices merely to lock and unlock the type wheels In these lock wheels there are a slight opening C. through which the type wheel lock arm passes at the moment of shifting, on every Machine composing a circuit The shifting devices are set in different positions so that one type wheel only of all the instruments can be shifted at a time, and unlike the ordinary mode shift all at the same time on all instruments, and also in this case I shift only when the type wheel lever is down and the magnet closed, and print when it is up

Thus preventing any of the type wheels of the several machines from shifting while transmitting a message to a particular instrument, which would be the case were I not to use a closed circuit on the Escapement Lever to do the shifting

I will mention here that after the lock wheel has been thrown into the fork, there is a slight dead motion between it and the fork which allows the Printing lever to come up towards the face of the type wheel far enough to release the unison but not enough to effect an impression or move the paper any great distance, this fork performs two functions the first, preventing the type wheel from jarring out or moving except in one position, and of preventing the Printing lever from effecting an impression.

I have previously said that I dispense with the figure fraction Wheel, but this is not necessary as a second shifting device may be attached to the ordinary Universal Stock which Second shifting device may be made to throw a disk in & out of a fork on the Printing Lever thus Locking & unlocking as is required, this second shifting device being operated when the type wheel circuit is closed while the ordinary shift device is operated as Commonly or formerly when the type wheel circuit is open,

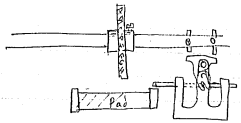
I do not wish to confine myself to any particular device for unlocking and locking, because they would be different according as they are attached to the various machines now in the market, I believe at this time of writing that I am the originator of the Idea of locking & unlocking a number of step by step Magnetic Printing Machines in one or more circuit from a central station

I am aware that Hughes has an arrangement for unlocking & locking his machines, but the machines used in the Stock reporting business, are on altogether different principles from the Hughes.

I will mention here that there are numerous ways of effect the lock and unlocking, both electrically and mechanically

One of these various modes is to have a severate magnet work a ratchet wheel, and this ratchet wheel having pins on it or upon its shaft may be thrown in the path of the Printing lever and prevent it from Printing as long as it remains, This magnet should be polarized - or have double helix and be effected by closure of both ckts.

Another mode is to dispense with the shifting of the type Wheel and its shifting devices on the shaft, and place them rigid upon the base attaching two pins only to the shaft thus



as in my shifting pad instrument, already Patented

A Cut in and out device might be used, this would consist of a polarized magnet working an Escapement, on the shaft of which an arm might project rubbing on a periphery of metal having one insulating opening, every instrument being provided with one of these, the insulated places being in different positions, and the magnet placed in the Printing ckt it might be made to revolve by intermitting a positive current and Cut out all the Printing magnets by reason of the arm remaining on the metallic ring and if it was desired to cut in any printing magnet the extra magnet would be rotated until the arm came to an insulated opening when the short cut would be destroyed and the Ptg magnet would be in ckt, while all the other machines would be out

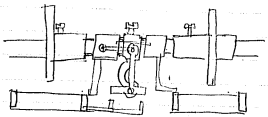
Then by using a negative current which would not effect the directive polarized magnet, the message Could be sent in that instrument. It is not necessary to Cut out the type wheels as they do no harm in being rotated altogether

This particular mode of cutting in and out electrically Can be varied in innumerable ways and I therefore do not wish to confine myself to that particular way

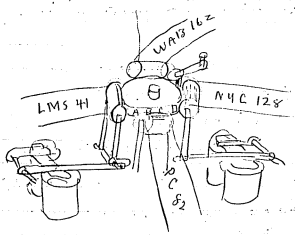
An Extra magnet not polarized might be used the type wheel Cutting that in and that cutting in the Ptg lever

53 Wright St, Newark N.J. Jany 2nd 1872 T A Edison
Jos J Murray

Since last writing I have made further improvements in the mechanical lock devices, As now constructed, I shift upon an opened circuit and at the same positions on all the type wheels, and not on a closed circuit as heretofore described, this makes it more practical and easier for the Transmitting Operator, The Unisons being all in different positions, it follows that if I wish to operate an instrument which says catches on the letter B I turn around a number of times to insure the stoppage of the Unison by the type Wheel and stop the transmitter pointer at B and close the Printing Lever and release the type wheel then of Course the type wheel & the transmitter Correspond, then I turn them both around until I come to the shifting peg then close the Ptg lever unlock the wheel and then transmit my message - In case some one of the Printing Machines did not happen to lock or got out accidentally the type wheel would not Correspond with the transmitter so the message would only be a jumble of unreadable letters, but be ok on the inst which the message is intended for, I could dispense allogether with shifting and locking of the Ptg Lever, as every inst would print a jumble of letters except the inst which it is intended to receive the message, but I prefer to lock the Ptg Lever, saving paper, and, as being more seemly & Convenient, I will state here that over a year ago I suggested to Genl Beffutt Should he wish to work an number of Private telegraph Printing Instruments on one circuit between a firm: office & factory Every pair of such instruments might have type wheels to Correspond but every other pair have type wheels similar but the letters placed in different positions So that no firm on the same Line could read the message of another firm -

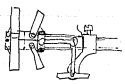


The above sketch represents a Printing instrument which has two type Wheels and Prints upon two strips of paper, this is done by one magnet working two printing levers or a seperate magnet to each lever but both in the same circuit and locking one or the other by the shifting device and arms,

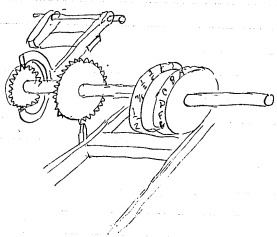


Device for Printing with a number of Printing levers from one type wheel, a seperate wire runs to each Printing magnet and one wire for the type wheel, The type wheel is rotated by a break wheel, A transmitter the used in sketch is a device which the type wheel may be arrested at any desired point by depressing a key, independent of the others in the same Circuit, The Speed is greatly increased with this device

Jan 4 1872 T A Edison
Witness by Jos J Murray

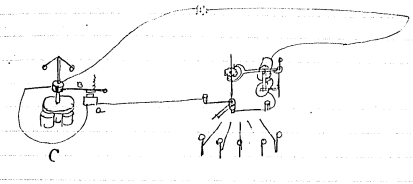


This is a double Type wheel having each wheel split in 3 or more segments and the inner ends pivoted on a set sleeve on the shaft. When the shifting device is thrown one way the segments of one type again a complete wheel ready for Printing while the segments of the other are thrown off at an angle thereby making it smaller than the other wheel.



Union Device, Extra 8 tooth wheel with a space where there is no teeth, when the Escapement lever is up and circuit open the prong on the Ptg Lever fits the teeth in extra wheel, no effect is produced & the Ptg takes place as usual, but if we wish to rotate the type wheel to Union should it be out we close the Escapment Lever circuit & bring escapment Lever down in so doing we bring the V teeth of second wheel in such a position that the prong on the Ptg lever when that is brought up will shove the type wheel around half a letter lifting the Escapment Lever out into half next to oth. & when the printing lever is let down the magnet working escapement which still continues closed brings escapment lever

down again and places teeth of second wheel again in a position to be thrown forward by the printing lever & so on until it comes to a place where there is no teeth then it is to unison, then open the Escapement lever circuit & go ahead in an open circuit in the usual manner, until you wish to catch all the instruments at Unison, then close circuit & work Printing lever until type wheel stops.



Arrangement for furnishing "breaks" for a whole line of Printing Instruments from a central station, by means of my Engine break already described in my Universal Printer Patent (and Caveat) This engine is of the same make as described on page 7 of this book but in this case I dispense with breaking the main circuit by the points on the armature lever of the letter arresting magnets and I also make the armature lever arrest the break wheel on the up stroke (10) when the magnet is open, and not closed as employed in the usual manner, I also include this magnet in the main circuit, so that every tho time the engine makes ~~two~~ one revolution two breaks are made and of course the arm of the arresting magnet vibrates with it but does not arrest the wheel. Now I provide the Type wheel shafts of the several instruments with projecting arms which pass in the path of keys now when a key is depressed the arm revolving around by the action of the Escapement ~~on~~ & magnet which receives to breaks from the engine break at the Central station, this arm is made of two springs in contact when revolving and are connected to the main circuit in such a manner that when this arm is arrested by the ~~key~~ the two springs are separated and the main circuit

opened, at the moment that this occurs there is not current on the line it being so adjusted that it will be at the interruption of the current on the break wheel = Now there being no current on the line the armature lever of the little arresting magnet stays up and catches the break wheel and arrests it, not on an open circuit but just as it commences to close, this insures a full break when the key is raised, for when it is the circuit is instantly closed the little lever is let down or drawn down and the break wheel revolves as before & so on, The Receiving instrument can have a vibrating point & Local Battery Connected with the Printing Lever So as to receive any message which may be sent, but I do not use any spring on the sending instrument, as I wish to dispense with a Local battery although it may be used =

I

In the instruments and lock devices just explained but one instrument Can be used at a time

But a shifting device might be added which would shift on a closed circuit on the Letter Z and a double unison made This shift might be made to shift and throw one unison out and the other one in the first unison for working a single not and the last to work them all, The last being set on all units alike the former at various places, Where it is necessary to work both the letter wheel and Figure wheel I add an extra shifting device for locking and unlocking =

I will state here that I lock on the fraction dot open circuit & unlock on the fraction dot closed circuit = on my Lock Instrument =

Jany 6th 1872. T A Edison

Witnessed
Samuel Edison

I am requested by General Lefferts to invent a peculiar unison for what is known as the Callahan 3 wire instrument

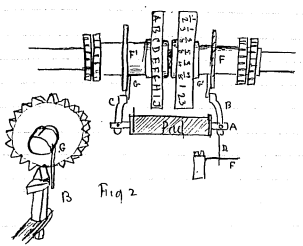


Fig 2

A is a slide peice which moves very freely through the pad or one side of it and is prevented from turning by the wire D passing between two guide wires F secured to a pillar =

Upon this slide is secured two peculiar shaped click B C. Fig 2 shows one of them to better advantage

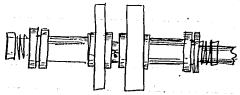
F F' are two star wheels secured to the two different Sleeves of the type wheels, and these wheels act the same as the unison device shown on page 18. Some of the teeth of the star wheel being cut out at a given position = G G' are pins secured to the Type wheel sleeves just back of the dots or Zero points = The purpose of these pin is to throw the slide and its clicks under one star wheel or other = Supposing both wheels to stand at Zero then the slide will be in a position where one click is directly underneath the star wheel of one type wheel and the other is thrown out one side, Now supposing that the letter wheel was in unison But the fraction wheel was not = Now when the Operator starts to rotate the Letter wheel, the pin G will come on the bevel of the click C and throw the Bar A over and bring the click directly underneath the star wheel of the Figure type wheel, which the star wheel of the Figure type wheel is out of Unison, (Bad drawing shows both under) Now the first Letter printed the printing Lever comes up

The click B, coming into the star teeth throws the type wheel ahead one letter and will continue to throw it ahead at every movement of the pouling lever until it comes to where there is no teeth on the star wheel then the type wheel will be at zero, Now as long as you work on the letter wheel the slide will remain over to the figure wheel side, but if not now the operator brings the letter wheel to zero, ~~or what~~ or tries to, and it is 2 letters behind and commences the rotation of the figure wheel, the first forward movement of the fiqure wheel by the aid of the pen I throws the slide over the click under the star wheel of the letter wheel that wheel will be brought to zero by the first two upward movements of the Printing lever

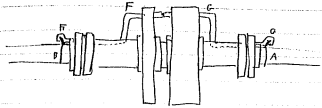
The whole thing is this B, a clicks is a "Connector" when one type wheel goes around it throws ~~B~~ the slide under the other for connecting the wire ronna

I do not wish to confine myself to a star wheel & V shaped click as I can use a ratchet wheel and ordinary click

Neither do I wish to confine myself to a sliding bar with Clicks on the Printing lever as the star or ratchet wheels may be made to slide by the action of the rotation of the type wheel and an arm or other devices accomed outside or independent of it.



Another union device each sleeve being provided with two little teeth slightly Bent and a pin on the shaft, If one wheel gets out of union the other wheels tooth grabs the tooth on the other wheel brings it up to the pin and they are then parted if one wheel goes ahead

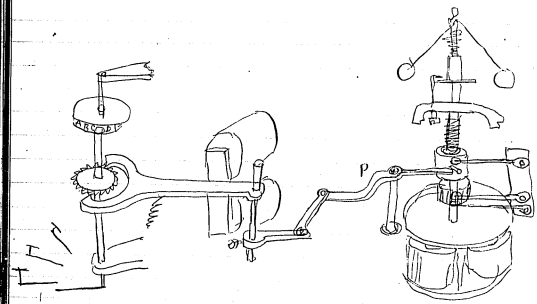


A B are flanges bent slightly at the union point F G are Carriers for locking the rotating wheel with the wheel to be set = one end of each has a head with a slot in it which works in the flanges A. B. When a type wheel is rotated around this carrier is thrown forward but is brought out of the path of the other Carrier between the type Wheels by having a portion of the flange A B bent outward just at the union point or last one or two Letters, It is not necessary to bend the Carriers up to the periphery of the type Wheels as I have shown =

Jany 8 1872 T A Edison witness Samuel Edison

Universal Machine = Instead of using the two arms and Connecting Springs upon the type wheel shaft and being in the path of the Keys The Connecting points for closing the Little Magnet in the Pulsator may be dispensed with and straight arms only used - When this is done I put a wheel having 30 fine points of Contact insulated between & Connected so as to revolve with the type wheel shaft, rubbing on this wheel is a Spring Connected to the pulsator Magnet so that by depressing a key the plain arms suddenly arrest the type Wheel and the Contact spring, just comes on a Contact point of the tooth wheel, and the pulsator wheel is arrested by the Little magnet, The type wheel shaft being arrested just a little way from its Limit the key being raised will allow it to reach its Entire Limit rotating the type W shaft a little & severing the Contact point, On account of the Speed with which the wheel is rotated, the spring though touching a point every Letter does it so quick that it has no effect on the Little Magnet

of the pulsator, but only when arrested for a small period of time
It is not necessary to use a Contact wheel with 30 point
as a rubbing Spring. A single spring secured to the shaft of the
Escapement Lever might be extended out some distance and
made to Close against a point just as the Escapement
Lever was nearly home or an open circuit.

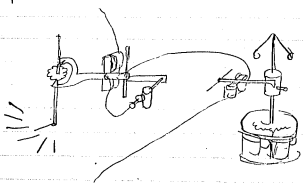


Improved method of catching or arresting the Little break
on the Engine in my Universal Printer, heretofore I have arrested
it first by a movement derived from the arresting of the pin
on the type wheel shaft, and the movement of that shaft
Secondly by closing a secondary circuit by arresting a
point on the type wheel and closing a magnet. the
armature of the magnet arresting the break
wheel, Thirdly the manner which which I describe
on page 26, and Lastly the above, The arresting of
The break wheel in this case is done by the direct
action of the Escapement Lever, The movement having
nothing to do with the type wheel shaft
I best only thing used as a means of stopping
the Escapement Lever at certain points by the
action of the points on the shaft going in the
path of the Keys and by the aid of the ratchet or
star wheel. it

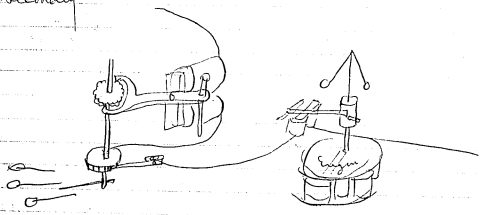
It will be seen by referring to the drawing that a lever
is connected to the Escapement Lever and that the end of
this Lever is in or out of the path of the ~~[illegible]~~ little pin
on the break wheel according to the position of the
Escapement Lever. When the Engine is running
it every half turn of the break wheel the magnet
operating the Escapement lever is closed consequently
the Lever P, is thrown into the path of the pin
on the break wheel and would arrest it, but the
break is so arranged that just as the pin is in
the act of being arrested the circuit of the Escapement
Lever Magnet is interrupted by the break and the
Escapement Lever flies back by the action of the spiral
spring and throws the arresting Lever P out
just in time to prevent catching on the pin
and the circuit is again immediately closed
the Lever is thrown in then jerked out every time
the type wheel advances one letter, ~~or if used~~
~~on Double ckt opens & close~~ consequently
the break is not interrupted but if we close
a key the pin on the type wheel shaft comes in
Contact with it, the Escapement Lever is
arrested half way which and the Lever P held
in the path of the pin on the break wheel
and the break wheel is arrested, now when
the key is raised the Escapement Lever is allowed
to go its full mension the Lever P is drawn
out and the break wheel revolves as before.
I do not wish to confine myself to any
particular lever, but claim arresting a
break wheel by a movement from the Escapement
Lever or any device attached to the Escapement Magnet
and holding the Lever in the path of the
~~type~~ Break wheel by arresting pin or pins
on the ~~type~~ wheel shaft by key or other
devices & Could used a seperate magnet
to arrest the Break wheel and place
it in the main circuit and put a

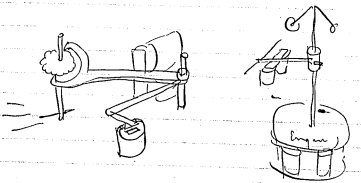
break point on the Escapement lever and arrest half way thereby opening this Extra Magnet and arresting the break wheel or put a wheel having 30 contact points on the type wheelshaft, and arrest the wheel by the keys & pins in such a position that the break main circuit would be open

This first

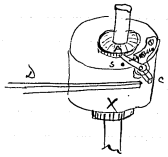


Secondly



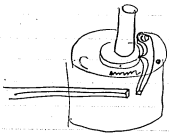


I will mention here that the friction cloth & spring used on the Engine shaft for friction to carry around the little break wheel might be dispensed with, and a clutch or click used the clutch being thrown out by the action of the arresting lever, this click or clutch would be provided with a stop so after the click had been thrown out a short distance it would come against a stop and the wheel would be arrested, one form I have since



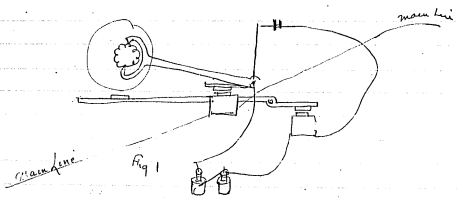
A is a milled wheel screwed to the revolving shaft
C the click X the break wheel S the arresting lever
S a limiting pin

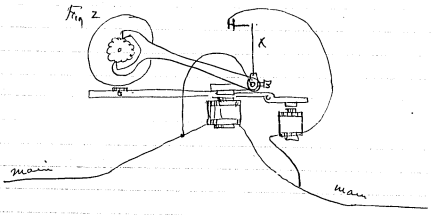
When the lever is not in the path of the break wheel pin the click is drawn to the face of the Milled Wheel by a spiral or flat spring thereby locking the break wheel to the revolving shaft, now if the lever S is depressed the point comes on the click thro immediately is thrown out and the limiting pin S stops the click from going out further and the wheel is stopped,



Another form

Attachment to the Universal Stock by which with the aid of a local it can be worked on one wire, or can be worked without a Local





The points X are adjusted so that when the Escapmt Lever has reached nearly the whole length of its play the contact point just touch, now when the Escapment is rotated rapidly the printing lever does not respond — In Fig 1 the Escapmt stops on an open ckt in Fig 2 on a closed circuit

Jany 13 1872 =

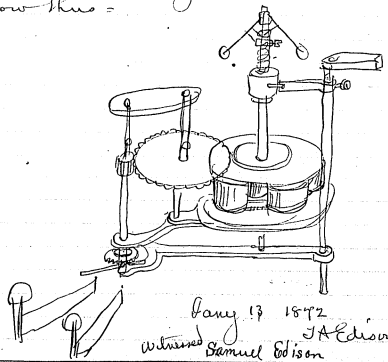
T A Edison

Witness
Samuel Edison

Wire Parking Printer

I wish it understood here that I can easily combine my Pulsator and arresting devices now used in my universal machine, to any form of Printing Telegraph (or) attach it or to any mechanism operated by step, or step motion or Escapmt, Rotetil Motor, or release escapmt or weight or other power or I can combine it in the form of a transmitter only in many different ways dispensing with the type wheel Ptg lever & printing devices,

I mention here, that I can gear up directly from the Engine, and on the last gear wheel shaft put a pin or arm or detent revolving in the path of Keys, and connect this arm with a V shaped wheel working an arresting lever Connected so as to arrest the break wheel on the main Shaft of the Engine, this wheel being carried around by friction, thus making a transmitter, The Universal as it is now operated can by modifying the arrester & platinizing the point on the break wheel be made to close a secondary circuit thus Enabling to work instruments which use two wires, The geared transmitter I show thus =



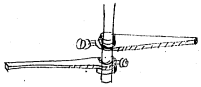
Jany 13 1872

T A Edison

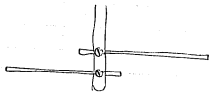
Witnessed Samuel Edison

It is of course obvious that my Universal Could be operated upon an open & closed circuit (ie) by opening the Circuit advance the type wheel one Letter and by Closing advance another Letter, but I prefer to use both opening & closed to make a letter it being on my Opinion More practical.

The pins on the shift of the Universal type wheel opening a Little and might be made in this way



Instead of



I claim a dead motion or the use of a dead motion in a star or wedge acting escapement for the purpose of giving the printing lever time to get away from the type wheel before it starts & not slurring the Letter, I believing myself the first one who discovered or used the method, other parties, (Phelps & Gray & Barton) using devices for throwing their printing levers back to the type wheel & then quickly back they not knowing this are wholly unnecessary provided there is a slight dead motion in their Escapement which they generally do

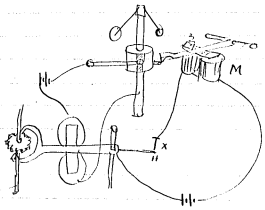
I claim the use of paper in a ~~Prin~~ single wheel Machine. 5/8 of an inch or more wide, when such paper is used with my paper drawing devices, or in other words I have found that 1/2 or less paper cannot be drawn or worked practically in a printing Telegraph which is operated by inexperienced persons

I do not wish to confine myself to any particular form of Electric Engine in my universal, nor even to an Electric Engine as the break wheel May be drawn with gearing or any other device operated by any force! Or the revolving wheel Can be dispensed with and a Vibrating lever used, operated by a local and this self Vibrator opening & Closing the Main Current and the arrester used same as that for arresting breaks wheel heretofore described and this arrester made to stop the Vibrating Lever or to open its current by a Contact point. Or the breaks may be furnished by a clock movement or any other devices, and the arrester made to act Electrically (ie) open the Main current so that when arrested in a certain position it will open the Main current & prevent any more breaks from being sent over the wire & when released allow the breaks to be sent. In fact a point connected to the Escapement lever of any permitting Telegraph Can be made to Control the devices which furnishes breaks by arresting it in certain points of its motion as well as to control the printing lever —

Jany 13 1872. T A Edison

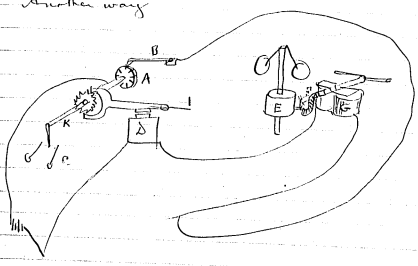
Witness Samuel Edison

I do not wish to confine myself to any particular method of annealing the break on my Universal, I can be done this way.



X and H are vibrating points work so quick dont allow current in arresting magnet long enough to close lever but when Key depressed and shaft arrested Escapement lever closes points X & H allows Current to circulate through M long enough to bring armature down and arrest the break wheel,

Another way

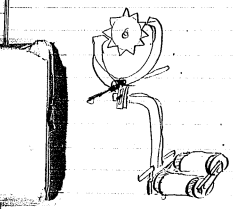


K is the shaft with point arrested by Key C A a break wheel with black points made of insulating substance, B a spring the points

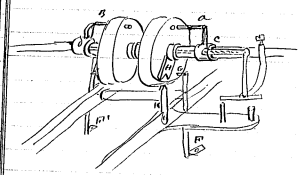
on the shaft is placed in such a position that when arrested the point B will be in one of the insulated parts of the Wheel A, The insulated points always passing under the spring B when the main circuit is broken by the break wheel consequently the breaking of the main circuit by the wheel A & spring B does not effect the regular pulsations, Now the magnet G being in the main circuit ~~being now~~ it vibrates its armature & anneals the same as the escapement The annealing lever going in & out between the pin on the break wheel twice every revolution or as many times as there is breaks on the wheel but does not arrest it, but if now a Key is depressed the break wheel A is arrested and the circuit is broken and the annealer is thrown or rather is not drawn down and the break wheel is arrested on a closed circuit but the circuit remains broken at B & A If the Key is raised the escapement is drawn a slight distance which the Key prevented and the circuit is closed the arrested lever is drawn down and the instrument goes on until arrested by another Key being depressed The Wheel A & spring B might be dispensed with and H under patent break substituted by putting it on the Escapement and so connecting it that when the Escapement lever is drawn to the magnet the circuit will be closed but when it goes back it will be broken I can use any devices to do this Several of these devices were described in a former caveat relating to Vibrating devices which at the time I intended to use on my Universal instead of the Engine,

June 15 1872 — 7 H Sims in

Witnessed — Jos T Mowry



Escapement



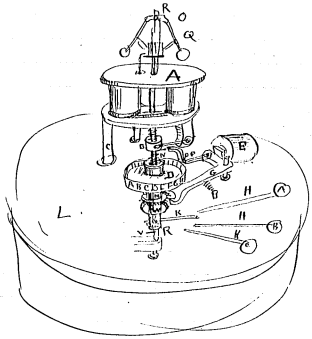
Two loose type wheels clutches a B c d connected together by two arms running in slots planed in the shaft. Type wheels are provided with two holes into either the clutch. Can be thrown by the shifting devices. H is an arm with a V cut in it underneath on the. Pty Lever is an arm K which goes in this V in H. The same is on the other wheel F' F'' to a retarding Spring G etc is a pin from type Wheel to hold it in position when it is unlocked or not carried around. The Operation is simple. If one wheel is locked by shifting the other wheel will stand one letter from Zero. But the arm K on the pointing lever ~~this~~ acting on H Carries the type wheel one notch to Zero in the act of unlocking ~~the~~ the type Wheel which is thus unlocked

and carried forward is prevent from wiggling ahead by the spring F' & pin G, but when this wheel is again locked, the force of the Magnet is plenty to overcome the spring F' and the type wheel is rotated.

Jany 17. 1872.
Witnessed =

T A Edison
Jos F Murray

A Printing Machine in which the Engine carries around the type Wheel, and the Escapement Lever on suitable



A is the Engine set up on pillars c etc R is the shaft driven by the Engine. Q is the governor, D is the break which arrested in the manner before described by a Connecting Link for F from the Escapement Lever G. This break wheel is arranged just the same as heretofore described. D is the type Wheel N the friction wheel Carries this type wheel around. When the Engine shaft R is moving. This type wheel is provided with a Long screw W which passes in the shaft R down through the

Base nearly to where R is pivoted & being prevented from going further by the pin V or any obstacles, (this position might be peculiar this) now this sleeve has on the release toothed wheel M the vibration of the Escapement G releasing the type wheel after the manner of a clock escapement, this sleeve is provided with an arm K which passes on the path of Keys and may be arrested by the depression of any key. Now when a Key is depressed the Vibrating lever G is held in such a position that the arrester F is thrown into the path of the pin on the break wheel and arrests it and the Machine at the other End is arrested by the stoppage of the break wheel and the consequent stoppage of the vibrating lever & release of type wheel

The break wheel might be connected directly with the type wheel in this case and the Lever F dispensed with, this simplifying it, but it would have to have 30 breaks, or as many as there are letters & figures.

The Escapement might be dispensed with also and a simple magnet with vibrating arm which vibrates in the path of the pin on the break wheel, When the Key was depressed on the transmitting instrument it would arrest the break wheel & type wheel on an open circuit, consequently the vibrating arm at the distant station would be arrested and arrested the break wheel & type wheel of that Machine & when the Key was released the sending machine type wheel would immediately start off & the breaks be sent over the wire & the magnet & its arrester commence to vibrate, this arrester is not only used to arrest the break wheel but to prevent the type wheel from going faster than the sender.

Jany 18 1872. T A Edison

Witnessed Jas F Murray

For printing fractions, the type wheel be made thus

The strip would read

NYC 125 3/4 .... WAB 64 3/8 .....

Or the type wheel could be arranged thus

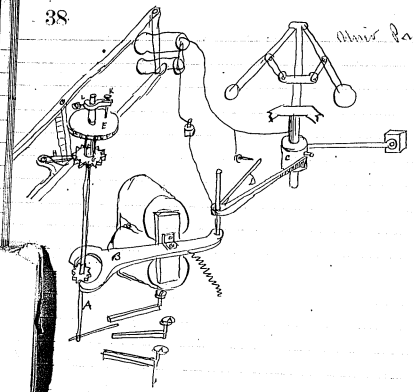
The 8.4.2 being cut on the type wheel where the spaces should be and to permit them strip in a closed circuit.

or it could be made thus

& the strip read thus

NYC 124.7 E ... S E ....

Jany 20 1872



Device or attachment which I use on my universal machine for printing Correctly when the type wheel is stopped by a Key a Little out of Line,

In my universal printing Machine, when sending the type wheel shaft is arrested by a key on the open circuit and a Little before the Escapement lever throws the type wheel to its proper position for printing, I do this to obtain a slight movement of the Lever B after a Key is raised so as to release the Break wheel C by the arm D. But in doing so the type wheel would be stopped half way between a Letter when the printing Lever Came up would print 1/2 of one Letter & 1/2 of the other Besides and objection would arise which is that it would be necessary to move the type wheel forward a half a Letter before the Circuit of the printing Lever would be opened Now this it couldnt do

Consequently the whole machine would stay Locked of Course the printing Lever might be thrown forward and the momentum print the Letter & fly back out of the road, or a device could be used so that when the type wheel was arrested the printing Circuit would Close for an instant print the Letter & Cut itself out until the next Letter, I have used ~~it~~ such an arrangement on a previous model of the Universal but Consider them all objectionable Now in this devices now being described the Key arrests the shaft A 1/2 way home consequently the type wheel is not in a Correct position to print, now to make it print Correct I use a Connector G on a sleeve F on which is Type Wheel F and guide pin K and holder L the slot in the holder has dead motion Enough to allow the type wheel & its sleeve a loss motion or play of more than a half a Letter, H is the Connector detent, wedge acting & Connected rigid to the printing Lever, If now a Key is depressed the shaft A is arrested 1/2 way home the printing Lever Closes the detent H acting in the wheel G ~~the~~ takes up all the dead motion of the type wheel on the shaft and throws it forward to the right position for printing, Now the shaft after the Key is raised Can go forward & open the Circuit of the printing Lever without moving the type wheel this allows the printing to fall back just in time to let the type wheel go forward In returning nothing is arrested Consequently the type wheel Comes right Every time or if not the Connector will Correct

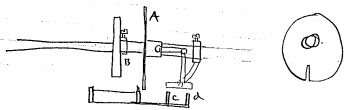
The Connecting wheel and detent

should be made thus

This shaped tooth allowing the detent to Connect the wheel then go ahead a little further to allow the printing Lever to print without moving the wheel.

I do not wish to confine myself to any particular devices for Connecting the wheel but claim a dead Motion of the type wheel upon the shaft so that a forward movement or a backward movement can be given to the type wheel by the action of the printing Lever

Lock device



A is a disk, B the type wheel C d the adjusting pins When you lock rotate shaft so as to bring the the disk on on printing lever and presents it from Coming up to unlock advance to C release the lever

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June 30 1872

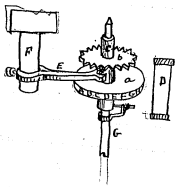
Jos. G. Murray

I mention here that on my universal the click on the printing Lever which Connects the type wheel should be a little springy at least Something should give, I have so fixed it already.

New Device on Universal

I use the connecting device, and closing the Local Circuit both on the vibrating spring on The arrester, But Combine another point of closure for the Printing Circuit when Transmitting Underneath all the keys is a plate this plate is insulated and so Connected to the switch which I use that when Transmitting the Local of the printing Circuit Cannot be closed until the arrester Comes in Contact with the pin on the break wheel and a key is depressed & in Connection with the Insulated plate before mentioned Now when the key is released the Circuit of the printing Lever is broken before the arrester arm is allowed to release the wheel so the printing lever gets away from the type wheel before it starts which is necessary as the printing lever pressing against the type wheel puts a large amount of friction upon which on the shaft and the power of the spring is not sufficient to pull the Escapement lever home and rotate the type wheel without it is very strong Consequently it sometimes starts the break wheel is not released by breaking & closing the Local Printing circuit in two places it allows the play

Lever to fly back before the type wheel starts
Consequently there is no friction on the
shaft when this takes place
There is one disadvantage to this and
that is the great number of points of
Contact
I have dispensed with this and use
it Mechanically thus

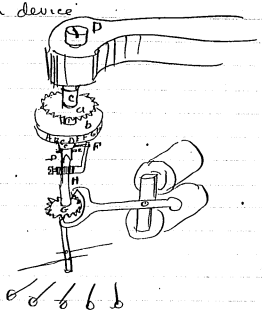


G is the shaft which is revolved by the
Escapement C is the Collar or sleeve on which
is the type wheel a Connector wheel b
Now this sleeves is larger than the shaft
and consequently will move sideways
slightly D is the printing lever
F is a rigid arm having a round forked end
around the sleeve and is just long
Enough to throw the wheel sideways
motion or shake in the sleeve towards the
printing lever,
Now when the printing lever is closed
the whole pressure Comes on the arm
E and not on the shaft G consequently
when the Escapement acts on the shaft G
to rotate it there is no friction or pressure
~~of the~~ from the Ptg lever,

Jany 31 1872

Jos J. Murray

another device



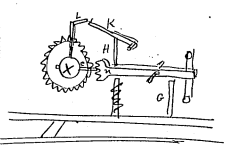
a the corrector b type wheel F Carrier,
C Sleeve D long center screw on which
sleeve & type W turn E pin keep sleeve
in centre screw H shaft G escapement
In this Case ~~shaft H don't Carry arm~~
The type wheel is not on the shaft
H but on its upper Center screw
it being carried around by a dog
or Carrier F secured to the shaft
H provided with a slot (aa)
into which is a pin from the type
wheel sleeve C - having sufficient
lateral motion to ~~it~~ allow of the type
wheel being corrected, the worm or unison
may be on the shaft or on the sleeve
In transmitting it is necessary to throw
the unison out. This I can do by
bringing the printing lever up a
little toward the type wheel
or by throwing the unison arm out
laterally - the Engine can be
stopped always in a given position
by the action of the ratchet so as to
ensure that it will start off when

The current is put on which it dont always do now,

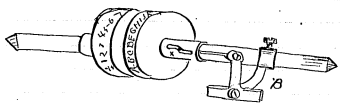
Feby 6th 1872 T A Edison

I will mention here that it may not be necessary to arrest the break wheel at all with this printing telegraph The Circuit might be opened by an action derived from the pin on the type wheel shaft and the springs a circuit opener being on these springs or alternate so that when the ~~pin~~ Come in load with a key it would open the main Circuit just at that moment when the key was raised closed it the break wheel going constantly would at all times furnish breaks but can they would be nullified by opening the circuit =

Unson



The revolution of Escapement Shaft or rather of type wheel shaft X brings pin C in tooth of rack n lifts it one tooth next revolution one more tooth & so on until the arm H throws arm K in path of L when shaft is arrested when pin C leaves cog the arm G throws Rack n down again & so on



Two type wheels, fraction & letter wheel
Letter wheel set so that the letter will be opposite space on fraction wheel
So that when it is printing from fraction wheel will not print its space coming over pad by revolving type wheels round right position
Closing pin over the 7 piece shifts the pin in the slot X and cams the fraction wheel ahead & right to print & same time throwing letter wheel behind so its space will come over pad
It can be done on one wheel
Letter then a figure letter then figure & so on when 60 characters 30 teeth in Escapement
Each tooth shows two letters
So every other one being a letter
Letter only print now
Come round to right position
shift and come wheel slightly ahead then fractions & figures will be right to print & letter not

February 6th 1872.

T A Edison
Inventor

1

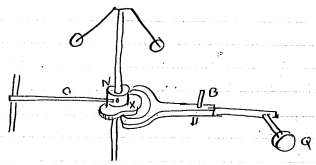
In my universal I have placed the Engine directly beneath the Printing Machine and underneath the base thereby making the Machine much More compact

The break wheel on my Universal has two Closures or metallic teeth and between these teeth is filled with Ivory, It is not necessary to have anything there as a limiting join might be used on the arm Carrying the Contact rollers, Still I prefer to use Some substance between these Contact teeth So that the roller will not knock their edges off and also to prevent noise, Now I have found in Experimenting that glass is the best thing that I can use as the Spark does not interfere with it as much as rubber ivory bone Etc and what is still better agate or garnet Could Substituted

There is considerable oxide formed on this Contact point and I propose to use a brush rubbing continuously up it to keep it clean also upon the Contact roller

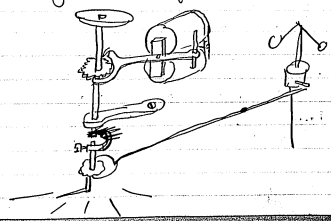
I will mention that the break wheel or pulsator may be made of metal Entirely and no cleats in it and the Vibrating arm may have a Contact spring upon it and this would be held and taken off as the wheel vibrates

It is not necessary that the pulsator should be exactly as I now use it is may be made thus



C is the arm arranged to the Escapement lever N is the wheel carried around by friction X is a flange on it which has two wavy teeth B is a lever which closes & opens the main circuit on the point Q the Vibration being had by the rotation of X and the two wavy teeth,

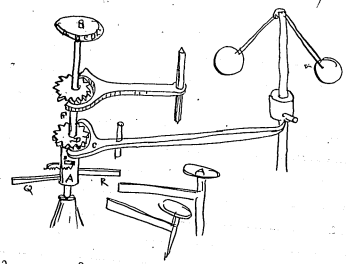
I have shown in former description the type wheel is arrested by the key 1/2 way home Consequently there must be some device to throw the type wheel in the right position to print, I can get rid of this device thus



In this Case the type wheel, Escapement etc is precisely like those in ordinary printers, but an extra shaft on which is a star wheel this star wheel giving motion to a lever which arrests the pulsator, now this second lever runs under the base and is stopped by the keys, the type wheel shaft will always be right for printing when starting running, but the extra lever which is carried around by the type wheel shaft will be arrested in a position to throw the arrester arm into the path of the pin on the pulsator,

This arrangement can be done with one shaft, the extra shaft being replaced by a sleeve

Thus



F is the main shaft, S a wheel which gives motion to the arresting lever C A is a sleeve with this wheel D on also with the key arm Q and R B is a slot having a pin in it and a spring fastened to the

sleeve to pull it around against the pin Now when a key is closed the escapement rotates around till it stops home but just as it is going home the arm on the sleeve comes against a key and the sleeve is arrested and the pulsator is caught but the escapement lever pulls the type wheel home the dead motion in the slot allowing this, the moment the key rises the spring pulls the sleeve up around instantly against the pin in the slot B before the type wheel shaft starts to move.

An extra magnet might be used to rotate the shaft which has arms on and the escapement lever have arm which arrest pulsator, and the Type wheel shaft be entirely independent and be rotated by another magnet & escapement lever or a springy connection might be attached from the escapement lever which rotates the type wheel shaft to the lever which rotates the key shaft & the extra magnet dispensed with,

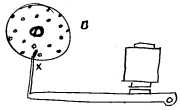
February 7th 1872

Witnessed

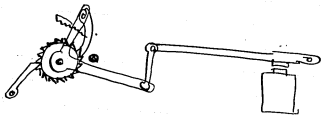
T. A. Edison

I have tried nearly all kinds of self acting breaks upon the Escapment lever of the Universal. so as to dispense with the Engine. but a change of adjustment of that lever increases or decreases the speed whereas the Engine does not to any great extent, another defect in a self acting break is that it is a very hard matter to regulate the break

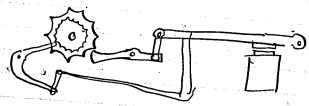
Escapement



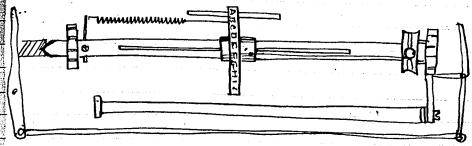
X is a dog with a Cam end B a face pin wheel, when it goes up it Cams ahead by the inner row coming down by the outer row ———

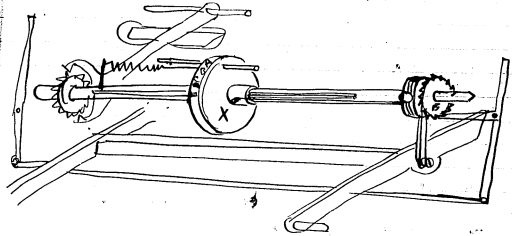


Another Escapement



main Generator

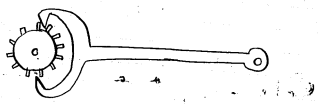




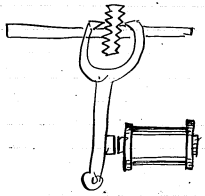
Travelling type wheel this wheel is rotated the same way as the ordinary printing Machine by an Escapement etc
The shaft is provided with a Key seat which the sleeve and type wheel travel Endwise B is a ratchet having a pulley by its side and this ratchet is rotated by a pawl from the printing Zone there is a string leading from the type wheel to this pulley which turns the corner on a little pulley wheel the other end of the type wheel is attached a spring

Now every time the type wheel is printed from the upward movement of the pty lever winds the string up the distance of one letter. when the type wheel reaches its full length it throws out the detention click and the spring pulls the type wheel back to its starting point and restores the detention click. an attachment may be made with the detention click to feed the paper a line ahead when it is moved

I am going to get up a machine with 26 trains of differential gearing Each gear having a letter of the alphabet and taking a hundred words and turn the gearing in such a manner that a few letters will be the result of these hundred words These letters can be transmitted over Atlantic Cable and then another machine in London can be set at these letters and rotated backward until the 100 wds are indicated I can then indicate or print the result

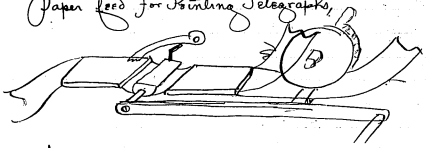


Escapement wedge acting square teeth,

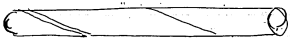


This is an old invention of mine but I record it,

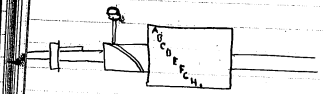
Paper feed for Printing Telegraphs,



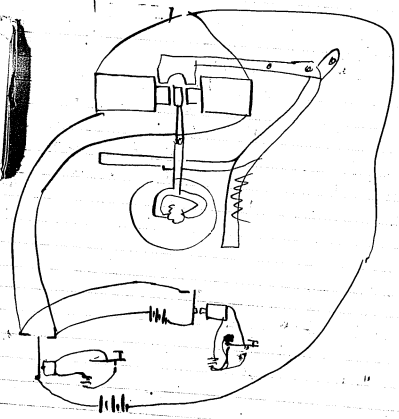
When you bow the paper the click prevents it coming back but when the bower attached to the printing lever goes up it lifts the click off and the paper straightens out by its own action thus throwing itself right for the next letter, Tried in 1869,



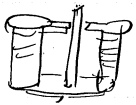
Feby 10 1872 T A Edison



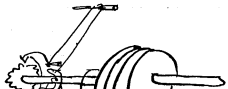
Type wheel with the letters placed as shown so as to get as small a diameter as possible, a twist drill might be used on the letters. Cut along the twist and beveled so that for every movement of the ratchet a new letter would come into position a pin following in the groove would give the endless motion and the ratchet would give the rotary motion after the drill or shaft having types would read it but it would be thrown back instantly by lifting out the pin in the groove and by a spring

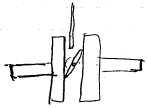


Device for a two wire instrument, close current on one wire one magnet draws escapement armature one way close on other wire other magnet draws the other way close both mag. circuits and both magnets close bringing down printing lever,



polarized relay bad iron or residual magnetism used only no steel,





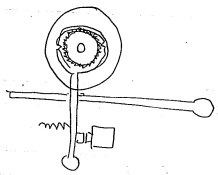
Device for using two type wheels having 15 character on one and 15 on the other and 15 teeth in the escapement and a shifter on the shaft so that in rotating it will shift on one & then the other

I claim slowing a printing lever by a piston attached to the printing lever run in a tube of mercury

Feby 12 1872

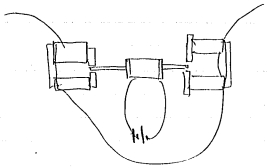
T A Edison

any of the arrangements described in my description of an apparatus invented for Andrews described in another book Can be applied to the printing lever



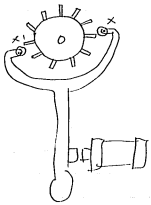
60 characters on the wheel 60 teeth in the Escapement figure between each letter stop on Open circuit to print letters (red) on closed circuit to print fractions and figures

My Wife = Cath Prudence
Poppy Wappy

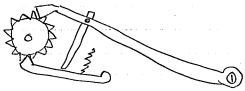


Polarized Relay Tones being polarized by a local battery Model Constructed in 1869 - Tuning Effects possession

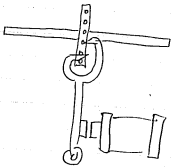
Escapement



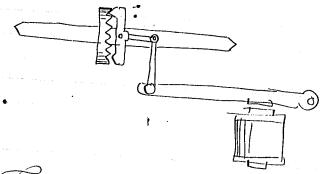
x x' Little wheels



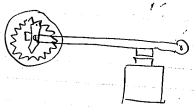
Escapement



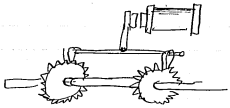
Escapement with Pin Wheel



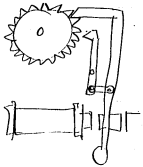
Crown wheel Escapement

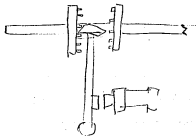


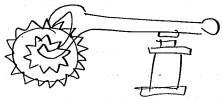
Inside star wheel Escapement



Double star wheel Escapement

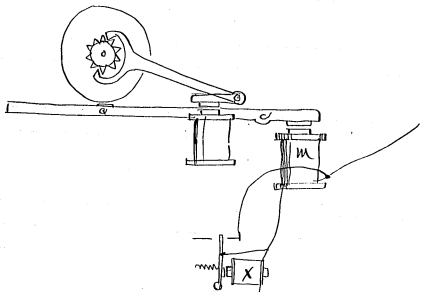






Inside & outside star wheel Escapement

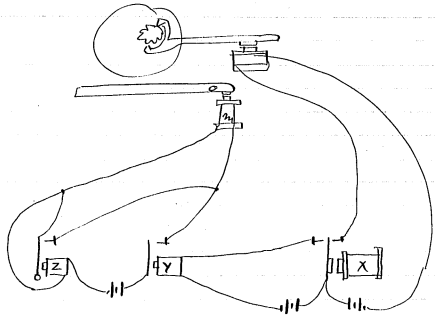
Feby 14 1872 T. A. Edison



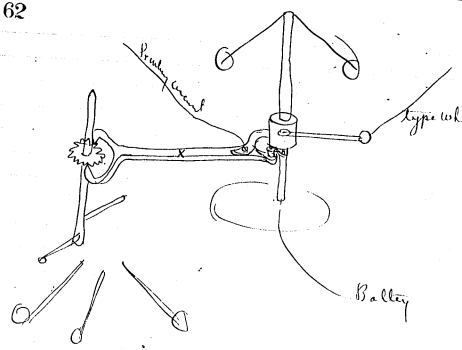
M is the printing Magnet X is an iron Magnet in same circuit, they both respond together but when the printing Lever just touches the type W the relay points close and cut it out and it flies back

9. Use this device for slowly upstream performing this operation

Thus



X is the main line relay front point vibrating Works type wheel around now when Type wheel in right position open Main Line relay Lever X flies back Closes Relay Y which closes printing circuit in which is Cut off relay Z and printing Magnet - M - both close and the Moment letter is printed Relay Z Cuts Current out of printing Magnet and Lever flies back



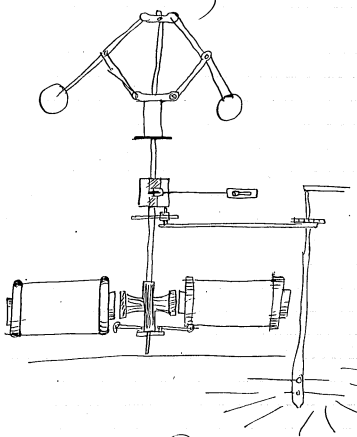
On the break wheel is a plate which has two teeth bevelled X is an arm having 2 prongs, one each of which is two little pinion rollers
(Fig) Every revolution of the Break wheel and the pinions engaging with the bevelled pins an intermittent motion is given arm X which acting on the Escapement wheel Rotates for Every revolution of the break wheel the ratchet is advanced two teeth there being 2 breaks on break wheel
(Fig) 2 bevelled pins, one prong is only necessary by using an spring in place of the other,

by depressing a Key the ratchet wheel shaft is arrested thus allows the arm X which arrests break wheel,

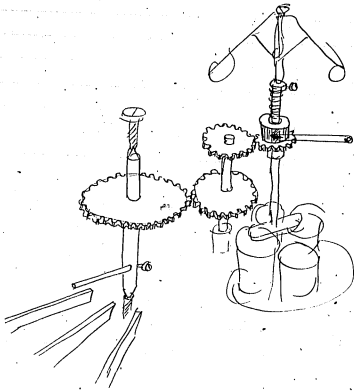
one of these prongs is insulated and Connected to the printing wire And when the break wheel is suddenly arrested the roller comes in Contact with the ~~bev~~ bevelled ~~tooth~~ (Fig) closes the printing current, I have a machine already made,

Feby 16 1872.

T. A. Edison



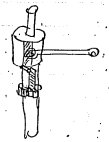
Arrangement of the Break in the Instrument



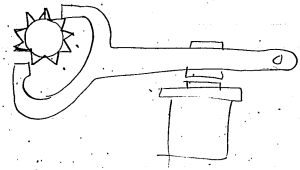
Universal break wheel working shaft that has stops on for arresting by keys (with gear wheels, I have previously shown & described) working with a rotated wheel for the rotated or intermittent revolution gear a Geneva stop wheel might be used in place of the gear having 30 stops on the shaft wheel & one on the break or more.

Feby 26th

This gear was previously suggested to Dean Feby 1. and thought before while working description on page 29

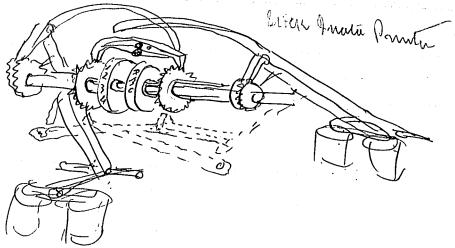


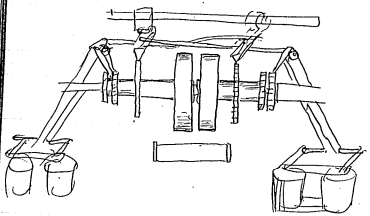
Carrier for break on the universal joint



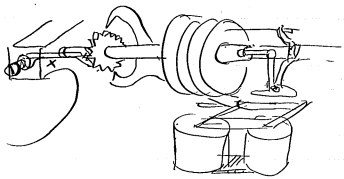
I claim Turning a type wheel by an engine (electric) or releasing it step by step by an Escapement (2) Magnet the pulsations being derived from ~~an~~ a break on the shaft of the Engine which rotates the type wheel =

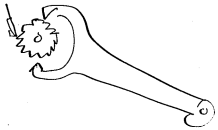
Unison For Callahans 8 wire Machine

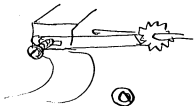


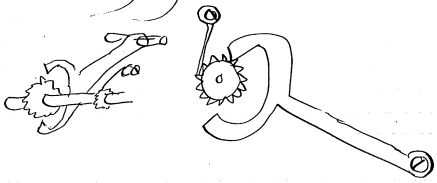


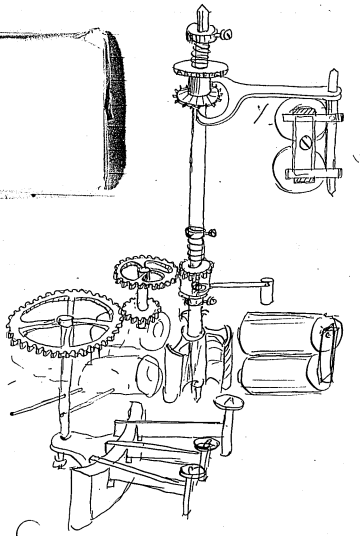
attachment to Universal Stock Printers, to prevent backlash in Escapement wheel when they are run at High Speed.









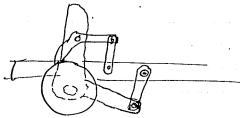


Printing Telegraph Machine The Engine shaft carrying the type wheel released by the escapement lever of the engine

March 6th 1872

G H Dawson

Inventor



Positive Paper Feed for Printing Telegraphs

May 24 1874. Vive la Republique!

To give a Moiré Antique appearance to Line like they put on Lee coats. Cover the line with Chloride of Cobalt & then in dil. Sulph. Ac.

Electromalorgraph Jany 2 1875

Caustic Soda Tin On Eltn O & H. phenomenal
Carb Cadmium Metal pen on H good "
Molybdate Soda Na Cl Tin on O mark. Tin on O
100 tremendous friction increased phenomenal
Cl Pb – Na Cl Platina & other good.
Carb Am, Tin Sticks fearful on O.
Carb Cadmium + Na Cl Tin stix on O fearful

18

Manganate Chl Chromate – phenomenal –
Simply fail on pen to
Eltn H or O. slight mark with
2 Cells Eltn. very bl of mark
left on brass flat with in O & H.
Can't get it on
brass pen Chl Na Eltn
EMG brass
lead not very good Mercy
brass
on both best on H.

January 2nd 1875 –

Experiment to obtain a good solution upon which to receive Tellurium marks also to ascertain if on this good solution Tellurium marks can be wiped out by Electricity or some Solution put on the marks.
Also to find a platina solution delicate, also to obtain a cheap delicate solution on other metal

Hypochlorite Calcium wipes out Tellurium marks Completely

Oxide Bismuth + Na Cl Platina on H. Te good
Platina wipes out Te splendid on O.

Bichloride Hg. Na Cl. Platina on H.

Chromate K + Na Cl. Platina on O. blots Te. Te good but leaves yellow mark after blotting

Cuxbhonate Manganese. Na Cl. Tin on H. Lead on H
Cl Pb – P pen Hyposulph soda marks good on H. gofer this

Caustic Baryta P on H faint mark.
Bromide of Potash Platina on O wipes out Te. leaves slight yellow mark

Nitrate Lead. Platina on both H best mark when you first touch "Musical sound as drawing along"

Hyposulph Soda. Cl Pb + Cl K. + Causlick K.

Carb Am. Na Cl. Lead on H
Molybdate Soda Tin pen marks on O.

Te marks splendid on Cl. K. best

Nitrate Soda Te Splendid
Nitrate Silver Per. C good.
Carbonate Per. Tin see slight mark. may be good.
Ch Magnesia Hydrochlor Marks on O. good Te bad

Dissemmer

Bisulphate Soda & Sul Zinc
Te fumes and spreads, hurts eyes & parched smell.

Cl Cadmium Te marks Splendid. P on O wipes mark out

Carb Cadmium & NaCl. Te good. P on O wipes it out good.

Molybdate Am – NaCl. Lead on H. Te good

Phosphate Soda & NaCl. Lead Splendid delicate on Te. dont show so black next morning though

Urate Am – NaCl. Te no good Lead splendid on H black in morning
Sul Lime NaCl. Te good P on O blots good

Bisulphate K. Te fair P on O blots fair

Ch Magnesium & NaCl. Te Splendid
P on O blots, Splendid Lead gives splendid mark on H not very black in morning

Phosphate ~~Manganese~~ Magnesia
Lead on H Splendid – Not very black in morning

Phosphate Am – NaCl. Te good P on O wipes out slowly

Carb Baryta NaCl. Te good P on O wipes out quick

Phosphate Soda NaCl. Te not very good P marks on H good, P6 splendid on H not extra black in morning

Boro Tin Te Hardly marks.

Bisulphite Soda Te good

Oxide Chromic Te good P on O blots.

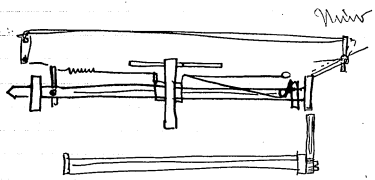
Nitrate Lime & NaCl. Te good P blots it out on O Extra black in morning

Bisulphate K NaCl. Very phenomenal
Te good spreads fearful. P on O wipes beautiful, leaves white mark where Te spreads thinly the white mark delicate if could be done Cheap would give good P solution

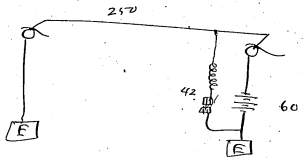
Mch 14th 1875

Leeds for plat selection

Rhubarb root marks faint points on it



Pointing above Telegh travelling type wheel



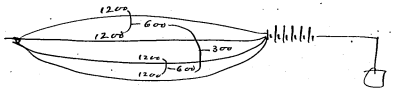
13
90
1170.

12.00

500
4

42

$13\frac{1}{2}$
50
650



24.

Newark Shop Notebook, Cat. 1182

This set of forty-eight unbound and numbered pages covers the periods July 1871-January 1872 and August-September 1875. The entries on pages 1-37 are signed by Edison and are in his hand. They deal with the development of automatic printing and chemical telegraphy. Detailed drawings supplement the text. The name of Joseph Murray appears frequently as a witness. The entries on pages 39-48 are in the hand of Charles Batchelor and relate to the electric pen, electromotograph, and battery tests. They are signed by Edison, Batchelor, James Adams, and Edward H. Johnson.

E 1674-2
Cat 1182

Nothing on file

Newark N.J. July 26th 1879.

Record of Ideas as they occur day by day applicable for the Dot & Dash system of Fast Telegraphy invented for Geo Harrington & D.N. Craig = All of which are for them with the exception of one undivided One fourth interest in all patents caveats or ideas I myself applicable to that system and the proceeds from that one fourth interest either directly or indirectly =

I do not record about few previously carried out inventions - but commence at this date to record all my ideas made previously to the opening of this book which I have not put in practical operation at the time of writing; and if possible all future ideas relating to this system while it shall be my interest to do so =

T A. Edison

July 28. 1871.

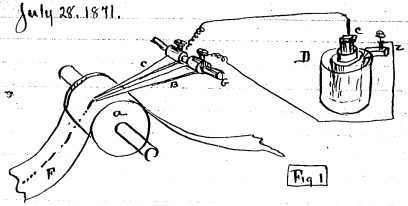


Fig 1

Chemical Telegraph Pen.

In this case I do not pass the current through the paper by using the paper carrying drum a as a conductor in the usual way, but pass the current from one pen to the other (pens c. B) across this paper the pens c B are insulated from each other on the shaft c and one connected with Carbon. and the other with Zinc, so if the paper a be chemically prepared and the drum a rotated a the chemicals with which the paper is saturated will be decomposed as long as the current passes from c to B through the paper, but if the current is interrupted the mark will cease. The object of arranging the pen in this manner is to make the paper resistance variable, so that when the paper is too wet or the line is short and there is too much battery on, the pens can be seperated which increases the resistance to the passage of the current. and a lighter mark is made which is too heavy or blurry when the paper is wet or the current too strong. Another advantage which this pen has is that. the distance which the current has to travel through the paper can be reduced to the $\frac{1}{500}$ of an inch or even less. consequently reducing the resistance greatly and allowing a number of these receiving apparatus to be worked in one circuit without the electrical contrivances which has been found necessary on account of the tremendous resistance which the current encounters in passing through the paper in some instances, paper properly wet. has a resistance of 200 miles of 13 ohms each to a current passing through it, But by the use of this pen the pens c B may be adjusted from 3 to 4 times as close as the thickness of the paper thereby reducing the resistance from to 50 to 75 miles

Continued

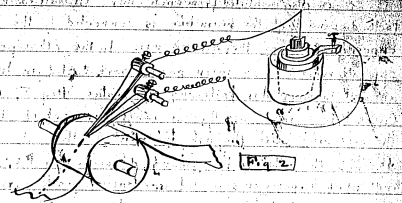


Fig 2

Fig 2

The pens may be arranged in this manner, one before the other, and a very close adjustment obtained – or what might be still better arrange them like that in fig 3. The pen C playing in between two prongs on the pen B the object of which is to get more surface on the non-recording pole or pen so as to reduce resistance.

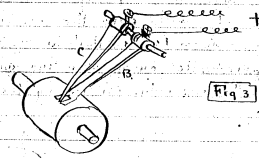
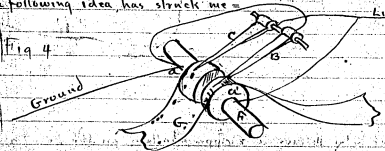


Fig 3

I have shown these pens with flat ends, but they may be provided with little rollers or wheels.

In sending positive or negative currents, for a chemical Telegraph the following idea has struck me –

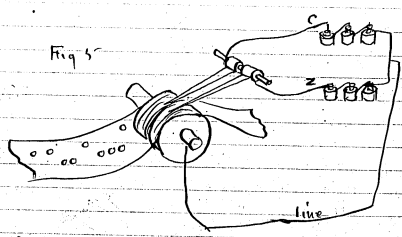
Fig 4



a and a' are paper carrying rollers insulated from each other on the driving shaft F on these two rollers are fixed

C. B also insulated from each other, it will be noticed by referring to the drawing that the main line is connected to the pen and the opposite roller and the ground wire to the other pen and the opposite roller = Now when paper perforated in two lines and sent through this following apparatus Fig 5, a positive Current will pass over the line when one set of holes passes under the pen and pass through the pen C through the paper thence through the roller to the ground decomposing the chemical solution with which the paper is saturated and leaving marks corresponding to the holes in the perforated paper at the other end of the line, now the same Current will pass through the roller a thence through the pen B and to the ground but in this case the current passes through the paper in an opposite direction consequently the marks if any will be underneath the paper and not be noticed while it will leave no mark on top - if now a current of opposite polarity is sent over the wire the reverse action takes place and the pen B records, so that a dot on one line will represent a dot and a dot on the other line will represent a dash. Fig 5 shows the apparatus for sending the double rowed perforated paper -

Fig 5



The upper row of holes throws a Copper battery on the line and the lower holes throw a Zinc battery on the line

Syphon, chemical pen. - or device for recording chemically upon "dry paper"

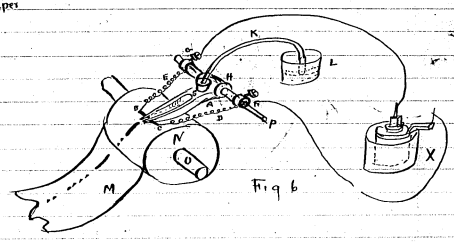


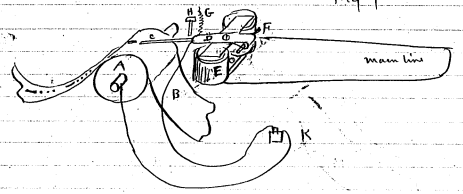
Fig 6

A is a hard rubber or any pen constructed after the manner of a drawing pen. it is secured to the shaft P and moves freely on it, and may be held closely on the paper by a spring. B and C are small platina points passing through each prong of the rubber pen at its extreme end and between which points the solution passes on to the paper E and D are wires connecting these points to the binding screws F and G and thence to the battery X S is a small funnel into which a syphon K leading from the reservoir L passes and keeps the pen supplied with the Chemical solution as fast as it is used Now when the drum N is revolved carrying the recording paper M. The pen goes out a continuous line of the chemical Solution which being colorless leaves no mark and is quickly absorbed by the paper. But if the Current is closed for an instant all the solution passing the platina points at that moment will be decomposed and passing on to the paper it will leave a mark. The syphon might be dispensed with and the solution supplied to the pen by dropping it drop by drop (according to the speed of the drum) into the funnel S. One fact I will mention here is that only that portion of the Solution which is directly in contact with the platina points will be decomposed -

All written July 28 1871
Witness Geo. G. Mesarvey T A Edison

Device for receiving by chemical Telegraphs =

Fig 7



In the ordinary way of receiving on chemical paper the pen or stylus C always remains in contact and the circuit of the main line is connected to it (or) the drum A, and the circuit opened (or) closed at the distant station leaves dots and dashes formed by action of the main line current upon the paper, But one great drawback to the practicability of receiving in this manner either by the main or local circuit is that the dots and dash Tail out, (ie) continue to make a mark after the Current has ceased, the reason of this has not yet been explained The above device is to prevent this "Tailing" and is brought about by connecting The Magnet E, point in the main Circuit and the stylus C Drum A chemical paper B armature D in a local Circuit within which is the battery K. H is a stop screw for D & a spring to draw D from the magnet the armature lever & pen holder (stylus) D pivoted at P.

When the Circuit on the main Line is closed it operates the Magnet E brings the stylus C down on the paper. (or) the Battery K decomposes the solution on the paper (or) leaves a mark as long as the magnet is closed if the Magnet is now opened the stylus C is lifted entirely off the paper by the action of the spring G etc thereby effectually preventing the tailing of the Character which is being received which would otherwise be the case if the pen was allowed to stay on the paper and the Current through it

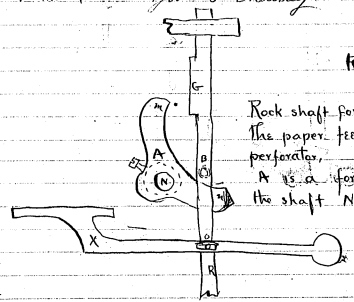
simply broken,

* The chemical paper might be dispensed with entirely and the record made from an inking ribbon. If the stylus C had a point or roller at its extreme End and an inking band passed gradually by clock work between it and the paper every time the magnet was activated by the Current the roller would be brought down and pressing the ink band on the paper leaving a mark, Or the Drum A might have an inking band wound around it and the pressure of the roller on the End of the stylus C would be sufficient to impress the ink upon the paper on the underside of the paper Or the drum A might have an inking roller to ink a slight line in the middle of its periphery directly under the roller ~~on the stylus~~ C. so that when the roller was brought down the pressure would be sufficient to make the paper take ink as long as the pressure Continued =

August 8th 1871 — J A. Edison,

Witness, Geo. T. Murray

Fig 8

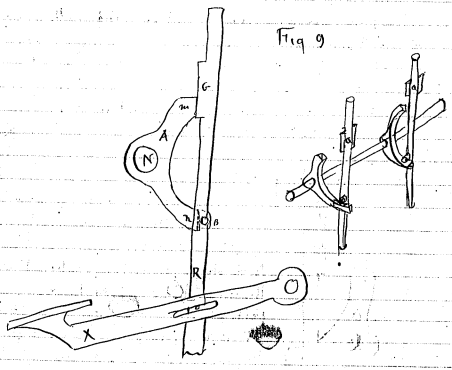


Rock shaft for giving motion to the paper feed in my large perforator,

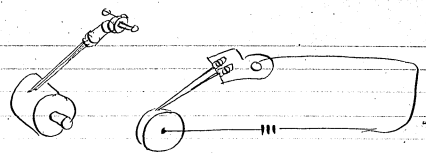
A is a fork piece secured to the shaft N by a screw or other means B is a pin having a roller on it G is a square piece

upon the upright R. When the key X is depressed the upright R is carried with it and the roller B coming in contact with the fork piece A at n. this rotates the shaft N, and at the same time the m end of the fork A comes in contact with the square G and the n end being down so far below the center that it ceases to act as a lever or means of rotating the shaft and the wheel or roller B slides down the straight part at N. It is obvious that by the two prongs being long and being arranged at two different points makes a perfect "lock" on the rock shaft N and prevents any momentum, of that shaft from taking up the dead motion, occasioned by imperfect mechanism there being a dead lock in this case and no loss motion to take up. Fig 9 will show the position of the fork and key when it is depressed to its full stroke and a dead lock takes place on the Rock shaft

Fig 9



Aug 8 1871.

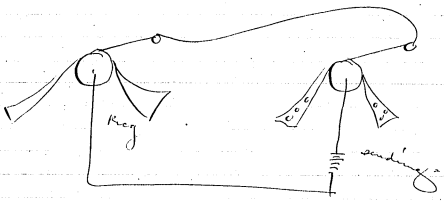


I claim two pens for recording chemically which shall be connected together electrically, one pen I put about the one hundredth of an inch ahead of the other in the same line, The object of this is to reduce the resistence of the paper. and make a double decomposition; as the resistence of the paper is reduced one half by having two points it follows that very near as much current will pass through each of the two points as one as twice as much current will be taken from the battery, now one pen passing over the paper will leave a mark of a certain intensity and another pen passing over the same mark will increase its intensity,

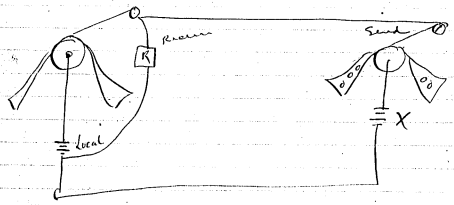
It is not necessary to have them one before the other for they may be placed side by side very close so that one pen shall make a very faint mark and the other will double its size so as to make it legible,

Another Idea, In a iron solution (10) prussiate of potash or other solution with which an iron pen is used to decompose and in which there is considerable acid, (see) excess of acid may be used so that when no current is passing the acid will attack the pen and produce a mark but when the current is passed through the pen & paper it will prevent the acid from attacking it or prevent the mark whatever it may be caused by, by this means the resistance of the paper may be materially reduced on account of the possibility of using an excess of acid

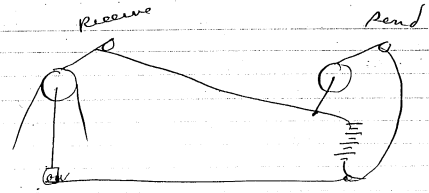
To produce this effect it would be necessary to arrange the Transmitting & Receiving Machines in this Manner



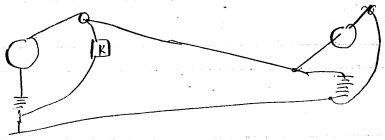
I will now illustrate & describe several methods of arranging the electrical Connections & battery for sending & Receiving:



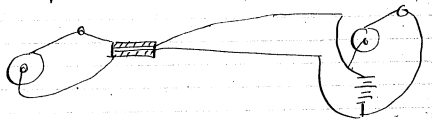
In this Case the Local is used to decompose the Chemical paper & the Main battery X to reproduce the effect by means of the perforated paper. K is the resistance Coil for adjusting the Local so that the battery X will exactly reproduce it



In this Case the Current or rather current is not broken but the battery is cut in & out by the perforated paper & pen
This Can be used with a local

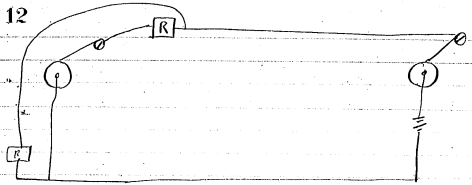


or with an induction coil the current not decomposing direct but acting in the ~~ste~~ primary coil induces sufficient Current in the Secondary to decompose

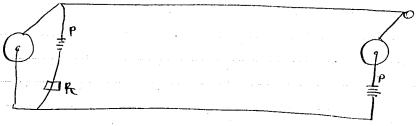


or the induction coil may be used thus

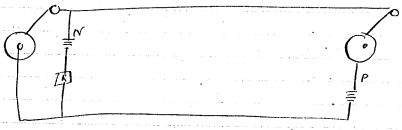
straight =



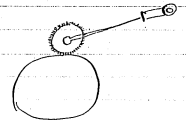
2 Resistance boxes adjusted so as to split the Current



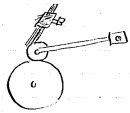
Local which decomposes and main line battery which also decomposed R coil in Local circuit to prevent the Local from making too plain a mark The use of this Local is to electrolize the atoms of chemical solution to a point where a slight increase would decompose it which is done by the main



Poles opposite, Main Line decomposing Local neutralizing, Excess of main over Local produces mark when it ceases Local cuts the mark short



fine ~~wheel~~ teeth wheel pen for recording on chemical paper,

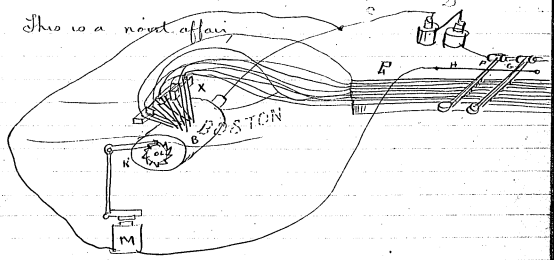


Wheel recording device on chemical paper, with a brush to keep it clean.

Jany 16 1872. J A Adam Inv
Witness Jos F Murray

A chemical printing Telegraph.

This is a novel affair



X is a bunch of flat platina wires second to insulating substance (a) Each wire insulated from its neighbor (b) the Ends brought down on the platina faced drum B very close so close that but a thickness of a piece of

tissue paper seperates any of them they make a solid mass about ⅛ of an inch square.

The chemically prepared paper passes between the brush square X and the drum B, This drum is fed ahead after every letter is made by the keys coming in connection with the rod H. This throwing the battery S through the magnet M as will be seen by the wires.

Now beneath the bank of keys are lineally five rods or as many rods as there are platina points in the pen square X. Each one of these bars being connected to a platina pen forming the brush. The bottom part of the levers or keys having tits or teeth on and these teeth are so arranged that they will connect the battery S through a given number of rods necessary to form a letter to the points on X and the current will pass down these selected points through the chemically prepared paper to the drum thence to the battery S leaving a blue or other colored mark at each point. For instance the letter H would be thus:

The first row of points would all mark a leaver (a) The second one dot of c the 3rd another dot of c the 4th another do &c the fifth row all the marks. The End view of the square is thus.

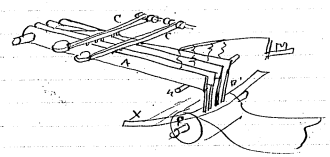
In practice it is possible to place them much closer than this it will be easily seen that certain points can be selected to give an letter figure & sign in any language. Now by raising the key the battery is thrown off of the decompassing points and through thrown through the magnet M which advances the Drum B ahead ready for

the next letter,

I do not wish to confine myself to printing on a strip of paper; as the Brush X might be made to travel over a Wide strip of paper side way. then back and at every step decompose a fifty or 40 more or less brushes might be used and a Commutator made to throw the Electrical Connection from one brush to another clear across the paper and after a line had been printed the paper could be advanced and the Commutator made to throw the Current back to the first brush at the next step by step to each brush until another line had been printed.

I could dispense with the magnet to draw the paper and substitute any power manipulated with suitable mechanism and controlled by the Key or keys. The bars might be dispensed with and wires substituted or any arrangement by which any given key could select the required number of recording points to make a letter.

I could dispense with the chemicals and record with ink in this way



A are the rods 25 more or less in number arranged like levers underneath the keys these levers have on their end the imbedding wires are arranged together in a bunch making a almost solid square each fine wire being connected to a lever and working seperately from all the rest. The end of all the wires attached

to the levers would appear this way &

The word ship being printed thus,

SHIP

But somewhat closer and legiable, the keys over these levers could have teeth arranged to actuate the levers or the levers could be provided with teeth which would mesh the most convenient,

The paper would be fed by a movement derived from the movement of the key or controlled by such movement ~~the way I will the Ends~~ in this machine I used an Ink band passing ~~beneath~~ between the marking points and the drum or rather paper which passes over the drum This Ink band is fed along by a movement derived from the key or may be driven by magnetism etc,

The principle of forming letters and printing them on strips of paper or other substances by the depression of keys I claime to be original with myself

I have shown the principle features but the small details are of no consequence being but ordinary movements well understood and easily combined,

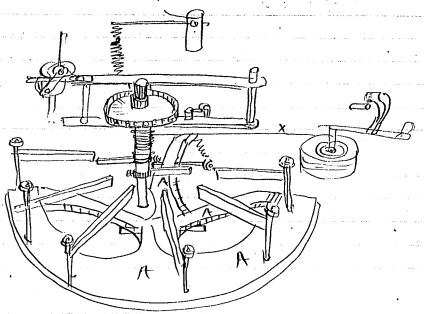
The ordinary perforating machine of my invention now in use could be provided with 25 bars similar to what is called punch but much thinner and the cushion in place of the punches and dies used and the ends of these levers being provided with the printing points closely gathered and fitted put on the bars so that the depression of the key would carry forward the required number of ~~pins~~ bars to form that letter corresponding to the key

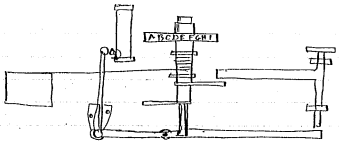
Jany 18 1872.

T A Edison
Inventor

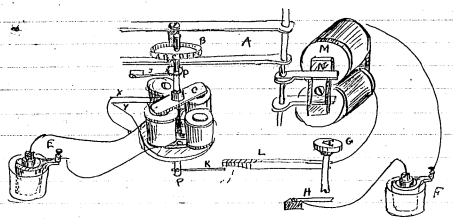
Jos T Murphy Edison

Printing Machine, Type writer for Cup





Printing Machine.



The object of this invention is to print rapidly on roman letters upon a a continuous strip of paper,

B is the type wheel P is the shaft running between centers, x through the bed of the Engine, C is the Engine revolving Armature x y the Engine break spgs. F the battery this armature C, revolves with tremendous rapidity (Ex) Carries the Shaft P and type Wheel B with it by friction, and when the shaft is arrested by the depression of the Key A arm L and the pin K the armature keep right on revolving and when the key A is raised the Shaft is free and the friction of ~~on~~ C. grabs the Shaft P & Carries it forward

A represents the Key of which there are 30 More or less, These Keys are arranged around in a Circle and have a Connection ring of which H, is a part and shows the operation This ring is Connected with one End of the battery to the printing Magnet M & thence to Keys So that when any Key is depressed the

bottom comes in Contact with the ring represented by H and the printing Magnet and the Printing is effected, Owing to the Immense rapidity of the revolution of the type wheel it is sure to be arrested before the Key closes on the ring and the Magnet changes,

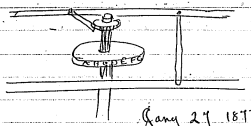
I do not wish to confine myself to this particular form as it may be necessary to adopt some devices to ensure the arrest of the type wheel before the printing magnet is closed this may be done by putting on a brick wheel on the type wheel shaft and arresting it on a closed circuit, or the Circuit may be closed on the Key A at L and the pin K.

What I claim is rotating a type wheel and Shaft by Magnetism, and Catching it by the Keys. (Ex) Printing by Magnetism or by any other forces, and allowing the Engine to go on after the types wheel has been arrested,

I is a ratchet wheel pawl which works in a ratchet wheel secured to the Shaft P. The use of which is to prevent a rebound when the pin K is arrested by the ~~Key~~ arm L of the Key, the ratchet pawl after the pin strikes L falls in a tooth and holds it there while the Letter is Being printed,

I do not wish to confine myself to this mode of ~~res~~ stopping the rebound, as the rebound may be taken up by a roughened wheel in place of the ratchet wheel on shaft P. (Ex) a pawl with a roughened surface Connected to the printing lever which when the lever Comes forward to print the pawl would give a forward motion to the type wheel Shaft P and bring it to the stop

and take up the rebound thus

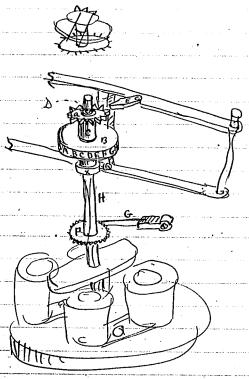


T A Edison

Jany 29 1872 Jos T Murray

I do not wish to confine myself to Magnetism for driving the type wheel shaft as a train of Gearing actuated by a Spring Weight or any other force Could be made to rotate the Shaft, the printing Could be effected by throwing an arm like from the printing Lever into the path of pegs on one of the gear wheels or the motion to print could be derived from the downward motion of the Keys =

I have this Printer arranged in this form now



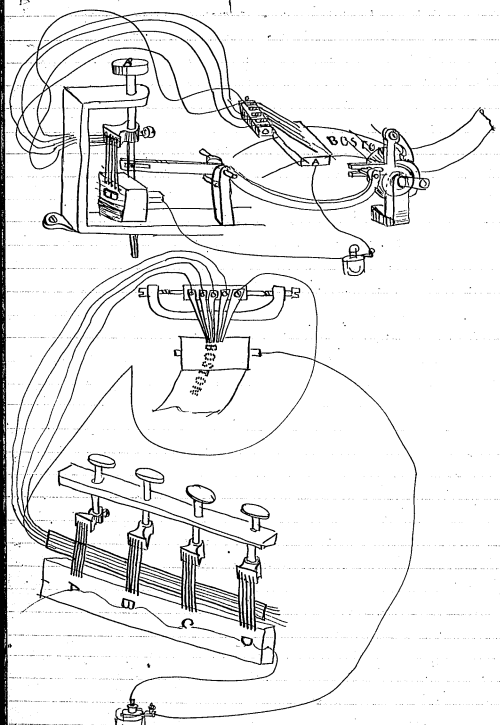
H the shaft. P & G the device previously described to prevent the rebound C a sleeve on which is secured the type wheel B, star connecting wheel a held up by the Collar X. E a detent for connecting position of type wheel, The sleeves & its devices is connected & carried around by the shaft H by a slot in the sleeve & a pin in the shaft shown at S. this slot is larger than the pin and allows some dead motion so that when the shaft is suddenly arrested by a key and it should rebound so that the pawl G did not happen to fall in the right tooth the type wheel being a little Loose the detent F would bring it right when the printing Lever Came forward

The speed of this printer might be increased by Cutting a double Alphabet on this wheel without increasing its size and double the speed Could be obtained in printing without increasing the speed of the rotation of the shaft H but the Letters would have to be a little smaller,

I may find it necessary to attach the interrupting break wheel to the Mainshaft to interrupt the printing Lever Current so that it Cannot Come forward until the type wheel has stopped, I used this on my Printing Machine the patent of which has already been applied for =

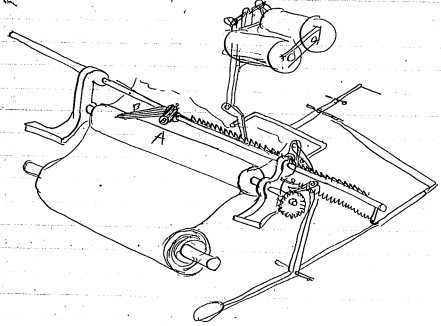
Jany 29 1872 T A Edison

I will now describe another printer
Worked Chemically



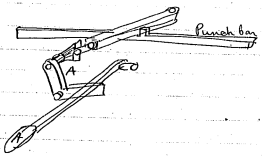
A discription of this apparatus is not very
necessary there are 30 keys. Each key is
provided with a comb ~~and~~ of
fine Contact points underneath the
Keys is a long piece of hard rubber
and metal letters of the alphabet sunk
in it flush with the top, ~~Each~~ there
is a recording comb also of five wires
rests on chemically prepared paper
rotated by a drum which is driven
forward by the depression of the key
Now the first wire in Every Key Comb
are all connected together the second
wire of Every Comb is also Connected
so on now the first wires of all
the Combs being Connected
together they are then Connected to
the first wire of the recording Comb
the second to the second
Now all the metal letters are
Connected together and attached
to a battery and the drum is
attached to the other End
So that by depressing a
Key its Comb passes over the
metal letter and advance
makes Contact sending necessary
pulsations to the recording Comb
to produce that particular letter
after the manner of the Bonnelli
Type Chemical Telegraph.
While the letter is being made
the paper advances by the action
of the Key The letters might be
placed on the key and the Comb
be made stationary.

The recording pen might be made to travel back & forward over a sheet of Manuscript paper & Make a Mid Tap. Thus



A is the main roll B Travelling pen the rest is easily understood - The Usual devices Can be used Similar to that used on my Mechanical Jointing Machine,

This is a new movement on my perforator for throwing the punch bars forward



A goes forward by depressing the key

until the round End of the Cross Bar goes over the Top then the punch bar is thrown back by the action of its spring Carrying the Cross Bar with it Now when the Elbow A Comes back it throws the Cross Bar upward by reason of the incline on the Elbow & passes under it there being enough deadmotion in the Cross Bar to allow of this

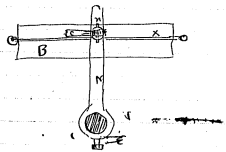
The Cross Bars have heretofore been provided or had their fulcrum of a thumbscrew. The thirty being secured on one long Bar. Now I propose to dispense with drilling & tapping 30 holes & using thirty screws by Casting slight tits or Bosses on the bar & milling them up and putting the Cross Bars on them & preventing them from Coming off by fastening a plate over the whole of them thus

A the brass piece & the Boss on the C the long Bar the tit & it being Cast in one piece
B is the plate which prevents those Cross pieces from slipping off the Bosses

I propose to try the experiment of dispensing with a spring to each key in my perforator. Surface at present are Thirty - by using a friction plate and have a small pin in the key and when the key rises suddenly it comes up sideways against this plate and gets a slight friction and sufficient to hold it there until again depressed.

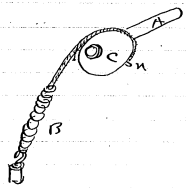
Now all the keys being held up this way I put a rod extending underneath the whole of these keys and connect a couple of springs to it so when a key is depressed it carries this bar with it and when let go the spring on the bar throws it up and the key with it,

On paper feed for the perforating machine I propose to alter it by putting in a swivel on the paper feed dog, thus



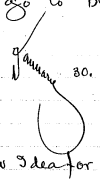
B, the stage N the swing lever connected to the rock shaft this lever performs an arc of a circle n is a ~~scrd~~ swivel into which the click is pivoted, X is a guide pin to keep the click straight

Device to get a constant spring motion of the rock shaft of my perforator, thus



A is the rock shaft B a spring C a cam or eccentric shaped wheel. n is a pin to which is secured the cord connected to the spring B,

Now when the shaft is rocked the spring gets closer to the fulcrum by reason of the eccentric wheel I go to bed

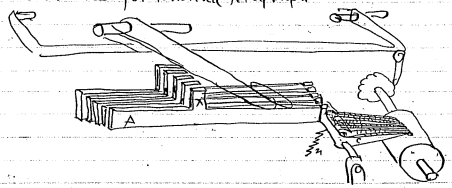


30. 1872.

T. A. Edison

Geo T. Moursey

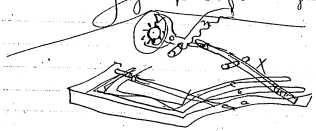
New Idea for Printing ~~Telegraph~~ Machine



A are 7 bars ~~are~~ moving 7 bars c up and down aff of the recording drum

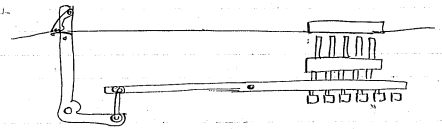
These seven levers are thrown down upon the drum by the forward movement of the bars A. This drum comes the paper between the paper and the C bars and an ink band. The A bars are grooved with 30 rows of tits down the side of which pass the side of 30 key. Now on the side of these tits are the letters of the alphabet in relief. The key in passing down throws forward the bars according to these relief parts of the letters on the tits at the same time the paper drum is being fed forward by the downward motion of the key. It will be seen that this is but a mechanical way of producing the result chemically shown on page 22 & 23 this book. Communication being had with the recording pens mechanically instead of electrically further description unnecessary.

Drawing paper for a perforator



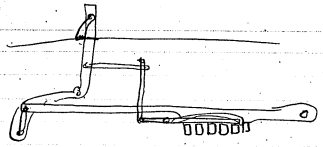
a b c some of the 9 punch levers used with perforator. X is a lever which has a rack click on the end. Lever going up down right going up

n a rack connected to a release escapement lever which releases the paper drum driven by weight, step by step. The last lever in the punch levers being nearer the fulcrum of X than the first will have X further now X is going down having a loose click does not vibrate rack n but in going up vibrates it releasing paper drum a notch. Every vibration the number of vibrations (being governed by the length which X has gone down which is governed by the punch used which is nearest to fulcrum it may be used this

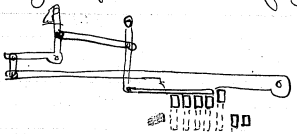


Description unnecessary

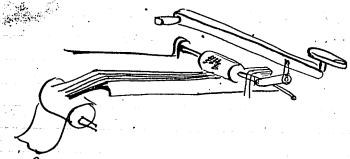
The printing device described on page 27. the seven recording levers might be cutting punches and cut the letters out instead of recording them then this prepared strip could be used for transmitting in a machine already described by mr manacher book where is better kind of paper



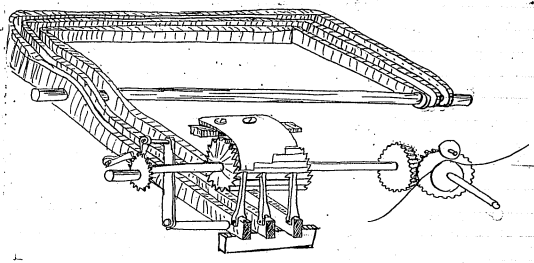
Punching paper feed mechanism for perforator



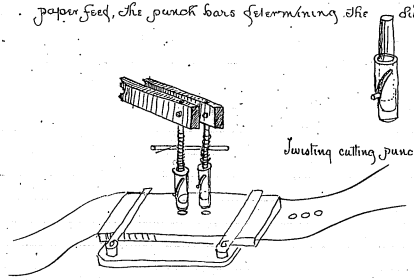
different



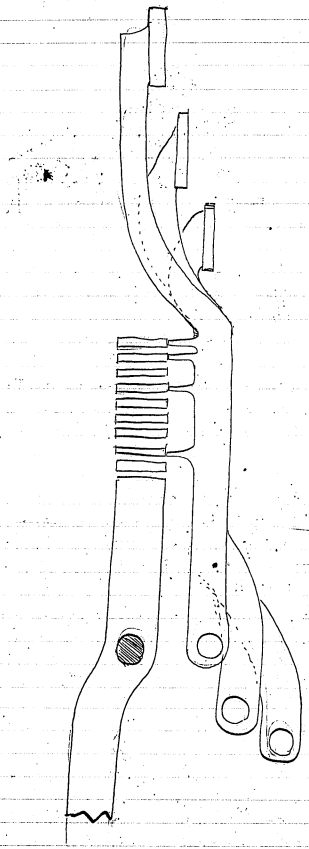
Punching Machine: different shape from that described on page 27.



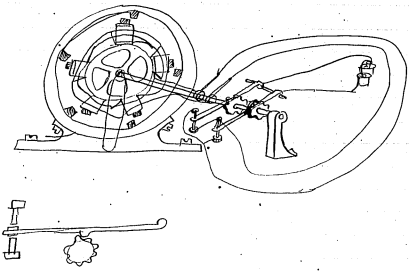
paper feed, the punch bars determining the distance



Twisting cutting punch



Electric Engine,

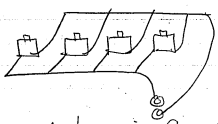


This Engine is somewhat dissimilar to that of any other heretofore made although resembling greatly in appearance other,

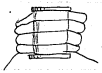
The outside ring is stationary & is provided with armatures, arranged in relation to the Magnets that when all the magnets are Charged Every magnet will draw itself up to the armature, the drum Carrying the Magnets will then revolve the distance between One of the armatures be charged and draw themselves up again

The break consists of two toothed wheels P Soldered from the shaft & each other and upon which revolve springs, also insulated from Each other These at the End of these springs are from platina points two above & two below so that when the teeth on the Wheels raise both Levers up they will come in contact with the both

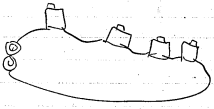
platina points and these platina points being Connected to the Magnets, and the two spring being Connected to the Battery the Circuit is thrown through all the magnets not as it is usually done but [redacted] way



These magnets and have in Constitution my improvement Consist of very fine wire say from No 20 to 36 or even finer When they are of finer wire Each magnet is made thus



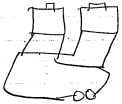
five or six Sections and Each Convolution, or section So Connected [redacted] The Current splits and divides passing through ely one wire through the six divisions provided for it & Emerging to one wire again, these magnets made better manner are Connected as shown in the top sketch or may be thus



It is a law of magnetism that the greater Number of Convolutions of wire around

the Core the greater would be the effect, taking Care about the resistance, I have for past experimenting with Electric Engines use very large wire and thus obtain a very low resistance, but have but few Convolutions. I also obtain an extraordinary low resistance by surrounding a number of roots Each having a large No of Convolutions and aggregately an enormous number but they were Connected that owing to the no of roots, Combined the resistance is reduced from say 300 ohms (if the wire is Connected as is ordinarily done) down to 2 ohms, for Each magnet and by Combining the Magnets after this plan I reduce the total Resistance of the Several Magnets to 1 ohm for the whole and at the same time have an enormous Number of Convolutions of wire, I have discovered that if 100 feet of Copper wire of ⅔ sparks heating, or one magnet has 6 [redacted] Resistance

and the Current is passed through it it will lift say 2 lbs, if now we take a magnet with 24 ohms resistance Each spool having 12 ohms & Connect them thus



or thus

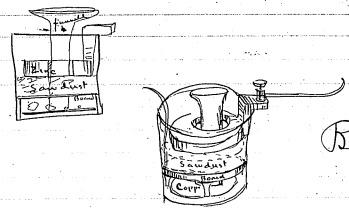
We reduce the resistance to 6 ohms but obtain three times the force or 4 lbs without any more Consumption of material in the battery –

Another thing I take advantage of in the Construction of my Engine which is that in all Electric Engines ~~now~~ now in use the Current though the magnet must be broken before the magnet apraches the point where the most work is done for if this was not done the armature passing would be retarded owing to the sluggishness which the Current or magnet always. I get around this by ~~from~~ keeping my Current on until up to Twenty Centr (1°) the armature is opposite the Poles of the magnet then it will be abandoned by reference to the break with its upper & lower springs that the Current is reversed for an instant through these magnet & thus instantly discharges the Current is not kept in long enough to effect a discharge of the opposite polarity

Another advantage I claim is having all the magnets pulling at one time and a large momentum or fly wheel to carry down the spaces between where the ~~not~~ pull

This opening of the magnets as described can be applied to other purposes

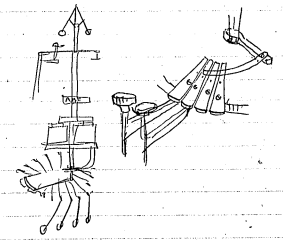
I propose to apply it to ~~to~~ operating telegraph Winding an ordinary Stock Bonnter 6 ohm 24 wire with No 30 wire 24 ohm and by connecting as heretofore shown reduce to 6 ohm



B. V. Ertel
Battery

I claim a board perforated with holes and setting on legs an inch or so from bottom underneath which is Copper sheet,
I claim the Saw dust on the perforated board or material of any kind perforated and a funnel for feeding the medium through the perforated disk with Sulphate Copper =

I claim running two ~~tyes~~ wheels by two Electro motors, and keeping them in unison by a governor on Each engine, and operating by a Single wire



X-R-1474 (-3)

Painter - Typewriter?
Ruffi Shades & glasses
Electric Pen
Copying Roller
Electromotograph
Inks
Batteries, Primary

XE1674

Aug 27th 1878

Had Wenzi alter 4 letters out of Mr Reiff's Stolz & Glidden printer by taking out the letter & putting in spikes

Chas. Batchelor.

Sep 2 1878 Reduplication of Copies

Made new roller for press of washers of cloth punched out like Fig 1 & put on an arbor in this manner Fig 2. The collars were made of cast iron & pinned on. The iron core left rough in middle & turned down in screw mach

Fig 1

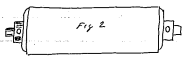


Fig 2

at each end the handle was bent like Fig 3 & the handle made like Fig 4 & rivetted into the frame & the handle were made in screw machine like 5

Fig 3

This was adopted as a model & work from. After all the cloth is on it must be shaved level.

Made new engine with No 22 wire spools & it works on one cup but we shall have two for an excess

Our new vibrator pen made by Gilliland is very good but it has kinks which deter it from going out to any body but a man that understands little about electricity. You could write much faster with it & it make better copy but sometimes it will run for hours & then stop, as soon however you touch it or perhaps shake it runs off again

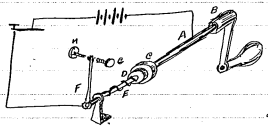
Ales improved the mk by adding molasses.

Chas Batchelor Jas Adams

T A Edison

Electromotograph. Sep 2nd 1878

Made a new style of Emg. We found that Acetate of Mercury & Caustic K were best for Emg. & we had an idea that if we could cover the drum with leather & keep it moist it would work just as well So we designed a machine like sample Fig 1



A is a spindle carried by handle B, on the end of which is a hard leather faced disk C, against which the plate D of Platina rubs. The handle being kept turned by friction of plate C against D keeps the point F against side of the screw. but when the current is put through & the friction discs kept moist with Acetate of Mercury & caustic K the lever will respond to every stroke of the key. This worked very well the first time for a wonder.

When freshly wet the mercury solutions work well on Emg repeating it as good as it comes but after laying by a while we find they do not work satisfactory

A small amount of either acetate of Mercury or of Caustic Potash does not work well

Thos A. Edison

Chas Batchelor
James Adams

Sep 3 1875

Inks.

Indigo Sulphate + Glycerine no good, insoluble
Printing ink + " no good
Common Printing ink alone very fair could do nice work with it but not near so well as with the Anilines.
Whale Oil + Union Blue no good
Printing Ink + Bears grease mixed no Good. Blot + run.
Aniline Black + Glycerine no good not soluble.
Glycerine + Union Blue no good

Thos. A. Edison
Chas. Batchelor
James Adams

Sep. 4th 1875
Found a new platina solution
Sulphate of Aniline & Protochloride of Iron
&
This is a specimen

Thos A Edison
Chas Batchelor
Jas Adams

September 10th 1875
Tests of Grove's Batteries for Polarization
1. 1 tablespoonful Bichromate K. dry,
3 " SO_3

Bradley Galvanometer	In 4 coil	65½ degrees
	40 second	61½
	60 "	60
	75 "	58½
	120 "	57

By shaking constantly it stands at 90°

2 By putting in 6 or 8 tablespoonfuls of SO_3 it stood at 78

10 secs.	68
20 "	65
90 "	57

By shaking it stands at 90 all the time

3 Powdered Bichromate K, put in bottle + a little more H_2O than was necessary to wet it then 4 tablespoonfuls SO_3 poured in shaken ½ min then filled with H_2O.

	75
5 seconds	60
40 sec	56
Shaken stands	68
Shaken with another zinc	65
1 min	58

3 Regular Electrolysis Shaken 68

10 secs	62 runs down
15 secs	60
20 secs	59

We have found Galv. wrong

4 Zinc & Single Bindpost of Galv.
Regular Elect. 65
1 min 60
2 min 59½

Stinks 65 when shaken constantly
In 1 minute runs to 60 stops 5 minutes at 59½ perhaps it will stop there. We now put up an Elect battery at 3 AM Sept 16. at 59½ deg. works engine powerfully & satisfactorily am keeping engine running constantly on it
3 ½ y a m no slack yet. 3.35 OK undiminished
3.45 ditto
4 AM Engine running with undiminished power
4.35 " " " " "
5 AM " " " " "
5.35 " " slightly diminished
6.10 " " Zinc considerably reduced
10.00 AM " " will still work but slow
11. AM " stopped.

5 Regular Bichromate K +
Acetate of Mercury 68
30 secs 61
60 secs 60½
90 secs 60½
2 mins 60½

6 Half regular Bichromate + Half water +
Ferrocyanide Copper 67
15 secs 58
30 " 57½
1 min 56
1.15 56
1.30 55

Phenomenon!!! Regular Elect, + Acetate Mercury Glycerine added after 10 or 20 seconds immense effervescence some powerful action on Glycerine

gives deflection of only 20.

7 Ferrocyanide K + Com Electrop. 53
10 secs 47
20 46½

8 Sal Ammoniac + Com. Elect. 68
10 seconds 61
15 " 60
30 " 55
needle keeps moving persistent & jars jarring depolarizes
60 seconds 56
probably stays at 56

9
Small jar Carbon + Copper
Com Electrop. 16 runs up to 20
add NO5 goes down.

10 Hydrochloric 4 drops only radint emf.
try it NO
15 secs 62
30 secs 60
1 min 59½
stops there
HCl too small

11 Small cell Acetic Acid + H_2O + ½ Carb of Lead tea-spoonful NO5 2 deg Rogon

12 Saltpetre + Com Electrop. 69
10 secs 59
30 secs 56
1 min 56
it will probably stay there.

13 Strong sol. Nitrate K. 15
added 20 drops Nit. A. no better
SO_3 added " 17 min

14 Tablespoonful chromic Acid + H_2O
30 rapidly polarizes
SO_3 added tablespoonful 55 rapidly
retreats to 50 45 40 35 30 28
probably stand there added Sulph Potash
40 35 30 min =

15 Regular Black + Elec Acid
69
10 secs 62
20 secs 60
1 min 58
goes gradually down
1 min 20 sec 56½

16 Sat Sol Bichrom K.
Tablespoonful SO_3 68 rapidly goes to 55
3 more teaspoonfuls SO_3. 70
1 min 69½
2 min 69½
3 min 69
stands at this again 70
1 min 68½
2 " 68.

17 A Grenet Battery one size No 1
holds 6 fluid oz H_2O.

18 ½ oz of powdered Bichrom K
½ fluid oz SO_3 — H_2O
5 sec 57
20 42
when shaken stands 60 after shaking
goes to 50 in 1 min stops there
another shake stood 62 goes to 55 in
5 seconds, 1 min 50½ added 1 fluid drm
more SO_3 — 60
10 sec 55
30 52
put ½ oz more Bichrom K
67
5 secs 65
10 64
30 63
60 62 stands there

19 1 oz Bichromate K
2 fluid drachms SO_3
68
10 sec 66
30 sec 63
1 min 61½
2 " 61
this is better than that on engine
shaken stands at 68
goes to 62 in 1 minute
8 minutes 58
10 " 57½
shaken again + goes to 57 in 1 min.

20 Regular Buchsen + H_2O 1/2 + 1/2

		68
10 secs		60
30 "		59½
1 min wnt		60
2 "	"	62
2½ "	"	63 Sue eats badly

though boils

Thos A Edison
Chas Batchelor
Geo Dowe Jr
James Adams

Newark Shop Notebook, Cat. 1172

This notebook covers the periods July 1871–February 1872 and April 1874–August 1875, with the majority of entries falling in 1875. The notes and drawings are in the hand of Thomas Edison and Charles Batchelor and deal with the development of the electric pen, electromotograph, automatic printing and chemical telegraphy, and multiplex telegraphy. There are many tests of chemical solutions and a few notes on battery and other experiments. Tapes treated with chemicals are affixed to pages 204–206, 208–210, and 212–213; examples of printed tape are on pages 289 and 290; samples of reproductions done by the electric pen are glued onto pages 228, 236, 238, and 254. Some of the experiments are signed and dated by Edison and Batchelor, and the names of Joseph Murray, Edward H. Johnson, Samuel Edison, James Adams, and Ezra T. Gilliland appear as witnesses. The book contains 294 numbered pages.

Blank pages not filmed: 34–35, 44–59, 94–125, 128–133, 136–157, 182–199, 242–243, 292–293.

Missing pages: 215–216, 251–252, 277–278.

Cabinet 578
Shelf 3

No Zeitfuchs

E1676
Cat 1172

Thomas A. Edison

Inventor

Telegraphic Apparatus

Thomas A. Edison

Inventor

Telegraph Apparatus

Umbrella Machine

Machine Machines

A Machines

Menlo Park Telegraph Co.

— Messenger Book —

Date	To —	address	Time
18.9 63/4	Edison	1 Laboratory ave	T A Edison 5 30 P.M.

Index

Tellurium 38

Automatic Printing. Telegraph. = Newark N.J. July 29. 1869

Invented by and for myself exclusively.

E-1676

Daily record of ideas as they occur applicable to this system, and a record of ideas already conceived, and account of experiments -

Dot (.) Dash (—) Automatic Printing Translating System, Invented for myself exclusively, and not for any small brained capitalist,

The general plan of this system is this:-

I propose to perforate or punch ~~in by~~ in paper in strips Roman Characters, by dies and punches, a punch and die of each Letter of the Alphabet, and made on the stencil principle = The Machine which I am about to describe will be provided with 30 Keys the depression of any one cutting out a Letter, after the manner of a stencil, and at the same time feed the paper ahead the distance of one Letter = ready for the next = After a strip of paper containing a message has been punched in this manner it is taken to a Sending Apparatus for transmission over the Line = This apparatus will be as follows = The Machine will have a paper carrying drum revolved by a weight or by magnetism, over the drum and revolving at right angles with it is another drum having ~~a springs~~ a number of springs in the same circle radiating off of the drum and all Connected to the Main Line when the Machine is in motion both drum revolve the paper carrying drum very slowly & the drum carrying the springs very fast = The drum upon which the paper is carried being connected to the battery Every time a spring passes over a portion of the Letter is closes the circuit through the apparatus of the Letter by the time one spring has passed over another Comes on in a different portion of the letter as the paper drum feeds the paper ahead a given distance Now another Machine precisely similar to this receives the message at the other End of the Line, the perforated paper being replaced with Chemically prepared paper It will be seen that if the two machines run in unison that an exact fac simile of the stencilized letters of the perforated slip will be record chemically at the other end of the Line, I propose to Construct two perfect Machines as near alike as possible, and provide each Machine with a very fine Electrical governor, and a Very convenient, delicate, and quick adjustment

for varying the speed, by the use of this contrivance and the attention of an expert to adjust instantly any differences. I hope to obtain 300 words legiably recorded every minute

The great advantage of this system of any other is that is but one machine which requires intelligence of any amount and that is the adjusting of the receiving instrument =

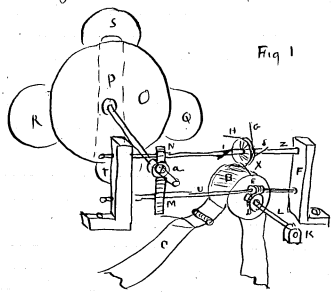


Fig 1

I will describe roughly the idea of my receiving and sending apparatus; B is the paper drum on the shaft L seamed to the bearing K D is a gear wheel E a worm on the shaft V M is a gear wheel driven by the worm a of the engine O is the fly wheel of the Engine Q R S T the magnets N is a gear wheel driven by the worm a Z the shaft carrying the wheel X with its sending or recording contact springs G H I J = C,S,S the paper; When the Engine starts the mechanism and all the parts revolve the shaft Z and springs quite rapidly and the paper carrying drum slowly, while say the spring G is passing from one end of the drum to the other and recording a portion of the letter, the paper carrying drum carries the paper ahead the $\frac{1}{64}$ of an inch so that when the spring H comes on the paper it records another portion of the letter the $\frac{1}{64}$ of an inch behind that of G And the wheel X being provided with a sufficient number of springs to record a letter at every revolution —

It may be found in practice that moving the paper feeding drum while the pens G H are crossing the paper may interfere with the record in that case the wheel D may be made and rotated step by step and adjusted so that just at the moment one pen leaves the paper, it will feed the drum ahead the $\frac{1}{64}$ of an inch before the other pen comes on the paper. The device is illustrated in fig. 2

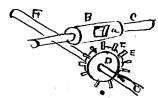


Fig 2

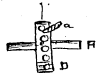


Fig 3

F is the shaft carrying the pin wheel D. provided with pins E E a is a cam on the drum B which is on the shaft C when the shaft C is rotated the cam a in passing between the pins E E cams the wheel D forward one pin Fig 3 shows the cam a just in the act of passing between one of the pins and caming the pin wheel ahead

The rotary motion of the pens might be dispensed with and the a back and forward motion made by a cam wheel on the driving shaft. in this case but one pen would be necessary. This would give a motion to the pen much easier than a rotary, for when rotated the spring bears harder on the paper when in the middle than when it comes in contact. Fig 4 will give an idea, of the devices by which I propose to accomplish the object =

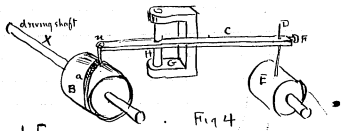


Fig 4

B is a drum with a groove planed or cut in it at an angle into which a pin n plays connected to the writing arm C. and when the driving shaft X is rotated the pin following the course of the slot gives a forward & backward motion to the shaft or rather arm C which of course impells the writing pen D. back and forth on the paper a drum E'. G is the support for the shaft H of the arm C =

The paper should be held down firmly upon the drum by a Shield thus :—

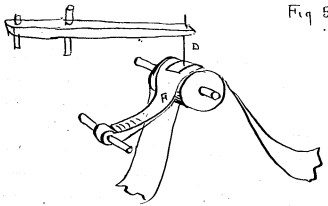
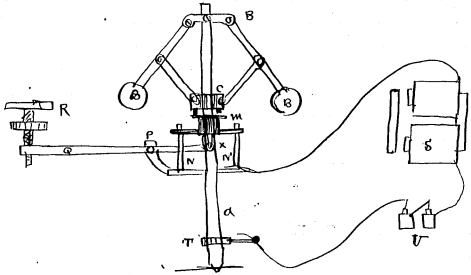


Fig 5

F is the shield, made preferably of an insulating substance,

The pen D may be provided with a small roller at its end for sending which I think will be found preferable to a flat pen, and it may be equally as good for receiving.

I propose to try several forms of Governors: fig 6 will give one



a is the shaft carrying the Governor. B B B is the governor C a collar which raises up on the shaft a as the speed increase & the balls spread out, M is another collar through which the shaft a passes but does not touch, the top part of this collar is platinized, and the bottom of the Collar C is provided with several platina points which rub on the platinized surface of the Collar M N N' are rigid rods upon which the Collar M slides up and down, Q is the adjusting rod for varying the speed, pivoted at p. and adjusted up & down by the Screw R This rod is secured to the Collar C at X. S are the Engine magnets U is the battery T is a collar upon which a spring rubs and is used as a means of connecting the battery with the shaft and its devices, It ~~will~~ is obvious that if the collar is adjusted to a certain position and the battery power is increased the speed of the Engine will be increased also, and the balls will spread out by reason of the increased speed, and lift the Collar C & its platina points off from the platinized surface on M and break the Circuit, until the speed diminishes sufficient to allow the balls to collapse when the circuit will be again closed

and so on the two collars will vibrate closely together alternately opening and closing the circuit & keeping the speed at the same rate. In practice I apprehend that the governor shown will not regulate the speed with sufficient accuracy if this is the case, a leverage can be obtained, and an extremely fine adjustment obtained by the following means

Fig 7.

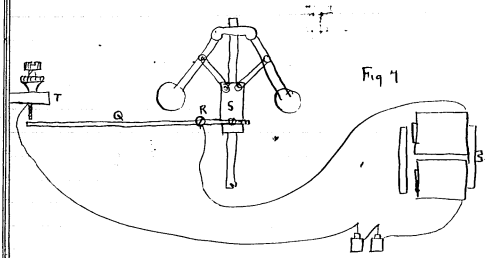


Fig 7

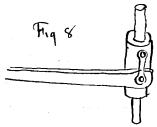


Fig 8

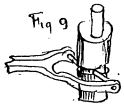


Fig 9

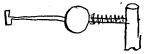


Fig 10

In fig 7 the electrical break as the speed increases is made by a lever Q secured to the Collar S by the devices shown in Figs 8 & 9 or in any usual manner This lever is pivoted at R, and the circuit is broken at T. By using this lever, and placing the fulcrum R in close proximity to the Collar S, greater leverage is obtained and the least rise of the governor balls quickly shows itself in

magnified proportions at the point T. Fig 10 shows a mode of arranging the governor balls. This governor device may be worked on a different principle, instead of breaking the Current of the Engine when it goes too fast and thereby slowing it, A magnet is arranged with a break upon the fly wheel and the governor made to break and make the circuit of this magnet and thereby put on and take off the break from the fly wheel. Fig 11 will show this arrangement

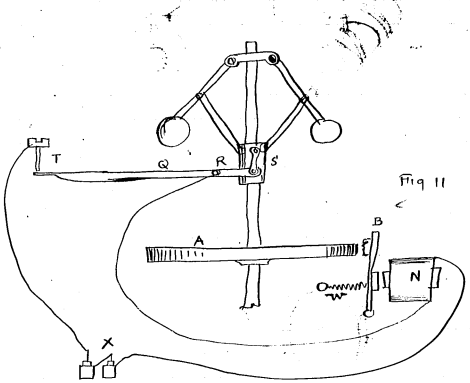


Fig 11

A is the fly wheel secured to the carrying shaft, B is a armature provided with a leather pad which when there is no circuit in the magnet N is held on the periphery of the wheel A by the spiral spring W. thus slowing it up, and the balls dropping closes the circuit at T through the magnet N, and pulls the break off from the fly wheel A, and doing this as often as the speed increases beyond the point set at T.

Instead of a worm and gear to drive the paper carrying wheel ahead the idea has occurred to me that a cam motion the same as shown in figure 4. could be used thus fig 12

Fig 12

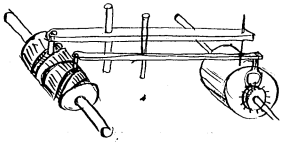


Fig 13

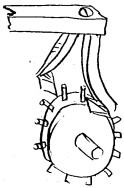


Fig 15

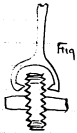


Fig 14

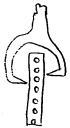


Fig 16

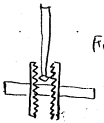


Fig 13 shows the manner of feeding the pin wheel ahead step by step — Fig 15 shows another device for feeding the paper carrying drum ahead step by step, twice for every revolution of the main driving shaft Fig 14 shows another view of fig 13

Fig 16 shows another device — Fig 17 shows another device for getting motion from the main shaft, and also for driving the paper drum

Fig 17

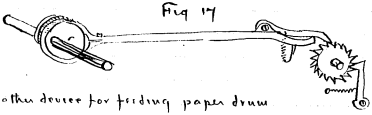


Fig 18 Is another device for feeding paper drum

Fig 18

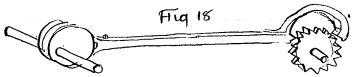


Fig 19 The same

Fig 19.

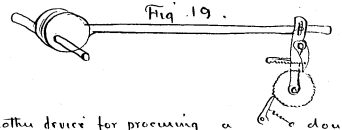


Fig 20 Another device for producing a double motion for each revolution of the driving shaft for feeding the paper drum —

Fig 20.

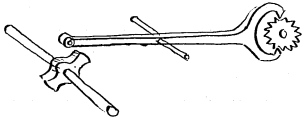
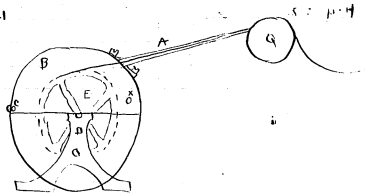


Fig 21 Represents a case for keeping the chemically prepared paper in to prevent evaporation, and to keep it wet and ready for use the moment the machine commences operation, heretofore in Chemical Telegraphs considerable trouble has been experienced in keeping the paper sufficiently damp to give a clear record, and I find that no provisions for exterminating this difficulty have been yet made to my knowledge. In my machine more than any other it is absolutely necessary that the paper should be in the machine and always ready for use, and owing to the slowness of the paper in passing

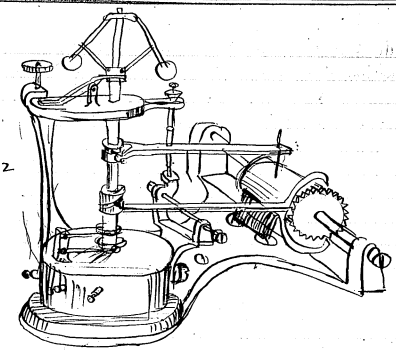
through the machine it would quickly dry in coming from a roll exposed to the air,

Fig 21



B is a metal case hinged at C provided with a handle x for opening This case is secured to the standard D. A is a long spout secured to B, and leading directly to the paper carrying & writing drum in which the paper passes E is the paper reel running within the Metal case upon Shaft the Centers of which run in the standard D. The rest of paper which has previously been prepared is set within the Case B and the end led through the spout A. and then closed, and being almost or air tight the paper will Keep moist and ready for use for weeks. It will be noticed that no part of the paper is exposed to the air until it reaches the paper Carrying drum ready to be used =

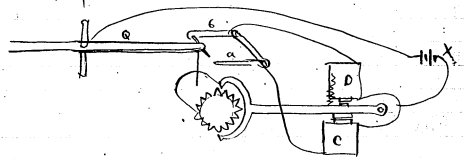
Fig 22



Proposed form for Constructing the Machine = Fig 22

In practice it may be found necessary to feed the paper drum by a seperate magnet, which will take an Intermittent work off from the Engine (or) perhaps add to the accuracy off the Unison of the two machine It may be done in this manner. Fig 23

Fig 23



a and b are contact points. each connected with the magnets C. D. the Connections arranged in the usual manner - When the writing pens comes over to one side it makes contact with one spring closes one magnet which feeds the paper ahead one Teeth (or) going backs throws the current from the battery X through the other magnet and closes

thus feeds the paper ahead another tooth =
One magnet could be dispensed with Q a spring used in its place

It also may be found necessary to make the writing pen travel straight across the paper and not perform an arc as I have heretofore shown Thus Fig 24

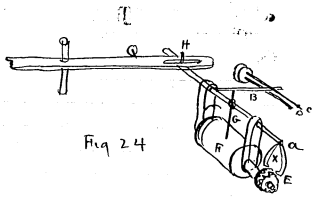


Fig 24

Q is the lever a a sliding bar carrying the pen C and prevented from tipping by the wire B and guides C O.
H is connected to Q by the pin H and slot
E is the paper feeding ratchet = Q and a might be connected by a link which would reduce the friction, The rotatel wheel E might be a double Crown wheel with V shaped teeth or a pin wheel and an a fork X made to feed the paper by the back & forward movement of the writing shaft a.

From Page 3 to Page 14 Written, and illustrated on the 29 & 30th of July (1871)

Witness Jos. F. Murray J A. Edison

In this system I intend to use an automatic letter puncher in my preface I mentioned that I intended to use and punch the letters in the paper upon the stencil principle, that is. The letter after being punched would resemble a stencil letter, the intersticies of the letters being held together by strips from outside of the paper = Thus, = ~~upon experimo~~

BON Fig 25

upon experimenting with this and several other previously Conceived ideas, I found that the inside of the letters or parts left after the letter was cut was very fraible or weak and that the transmitting stylus or other device would be liable to break them out in passing over them and thus destroy the legiability of the letter at the other End of the line = The best form for punching or preparing the letters I found was to form them of a large number of small holes. Thus :—

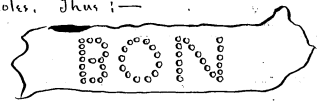


Fig 26

When the letter is punched in this manner no part of the paper left within a letter after punching is materially weakened, at least not weak enough to produce inconvenience in transmitting the same,
I also find that by adopting this mode and way of making a letter, the Mechanical difficulties which would be encountered in preparing messages by a stencil letter would, be greatly reduced by making the letter in the manner last described, Another advantage in using the perforated letter composed of Samall holes. is that the received copy at the other End of the Line is much more legiable, and has a more handsome appearance

The copy of received from a stencil letter would resemble the following

BON

Fig 27

While that received from the letter composed of round holes would be thus ...

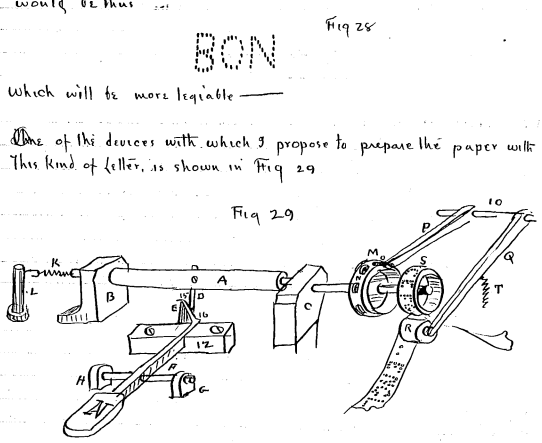
BON

Fig 28

which will be more legiable ——

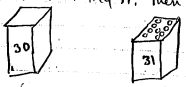
One of the devices with which I propose to prepare the paper with this kind of letter, is shown in Fig 29

Fig 29

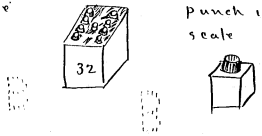


S is a Hollow Drum in which is fitted 28. letters formed of holes. The manner of making each letter I will briefly explain before I give a description of the Machine

A block Fig 30. of steel is drilled from end to end with holes to form the letter thus Fig 31. Then the metal around these



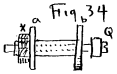
holes is filed or cut away so as to leave the edge of the hole sharp enough to cut a hole in the paper when pressed on it. Fig 32 will show this, and Fig 33 will show one single punch in this manner on a magnified scale



These block each containing a letter of the alphabet is set in the periphery of the wheel S. and secured firmly to it

R is the roller which carries the paper and upon which the letter is cut out, This roller is formed in a peculiar manner, to withstand the constant wear of the cutting punches on it after passing through the paper. Fig 34 will show the metallic portion of the roller

Fig 34



The flanges a b of this roller is filled with washes of raw hide, or cat gut, or with paper and then subjected to an immense pressure and held together by the nut x. Then turned of smoothly in a lathe. These two substances when arranged in this manner have a "peculiarity" which no other discovered substance has, or is known to have. That is that the cutting edges of punches or knifes or sharp tools do not wear them at all and they will stand for months of continuous cutting. and still preserve their specific peculiarity or quatity Now it will be seen by referring to fig 29. that when a letter with its cutting edges is brought directly under the roller R and the Lever Q lifted upwards with sufficient force. the cutting edges of the punches will cut through the paper on to the raw hide roller R and punch a letter —

The manner in which I bring around any desired letter & have the lever Q raise the drum R upwards to the face of the drum S. I will not explain:—

B & C are frames in which the shaft A run, upon which shaft is two wheels S and M. the latter having teeth upon one side of its periphery. on the other side is a pin o rubbing continuously upon said periphery. This pin is connected rigidly to the lever P which is connected rigidly with the lever Q by means of the shaft 10. so that when the lever P is raised it raises the Lever Q and drum R with it T is a spring to keep the pin o down upon the periphery of the wheel M where there are no teeth. The shaft A slides endwise. but is prevented from doing so when not operated, by the Spring K secured to the shaft and standard L

The manner of arresting the rotation of the shaft and throwing it forward of endwise is quite simple

N is the finger key pivoted on the shaft F, which runs in the bearings H and G and the end of the key N is bent in the manner shown in the drawing. so that when the key is depressed the cam or bent end E is thrown into the path of the pin D on the revolving shaft A. the pin D first strikes the bent end at 15 and the shaft continuing to rotate, the it is cammed forward or endwise and then suddenly arrested by the straight part of the key at 16 The moment that the shaft is moved endwise ~~that pin O~~ on the lever P ~~is thrown~~ further that portion of the periphery on the wheel M which has the teeth is thrown into the path of the pin O on the lever P which riding upward on one of the teeth lifts the lever Q and drum R and paper up to the letter which corresponds to the arm D upon the wheel S. with sufficient force to cut it out Now the moment the Key N is allowed to be released, the spring K pulls the shaft back and throwing the teeth on the wheel M out of the path of the pin O. and the shaft commences to revolve again, before this is done the pin O would have passed over a tooth on the wheel M and effected ~~throw~~ cutting out of the letter a

dropped down out of the way before the shaft was released. The shaft A could be provided with 28 or 30 pins set in different positions upon the shaft and directly in the path of as many keys similar to N. so that by depressed any key a certain character upon the die wheel S could be brought in the desired position, In practice it may be found necessary to dispense with the teeth ~~and~~ on the wheel M and substitute in their place undulatory "faces" as shown in Fig 35 This would be a positive movement and prevent any momentum being given to the levers P & Q by the suddenness with which the teeth strikes the pin O.

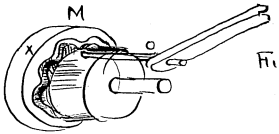
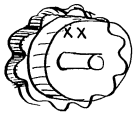
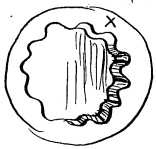


Fig 35

Fig 36.



37



When the Wheel M is thrown forward the pin O enters the undulatory cams at its lowest point and rides up and down one undulation ~~when~~ which lifting the Levers P & Q and punching the letter is thrown out of these slots by the wheel M moving back and then the pin O rides upon the smooth portion of the periphery

Fig 36 & 37 shows how these slots are made XX being fitted inside of X and both secured together and with the ~~sh~~ shaft = The manner in which I propose to move the paper, I will

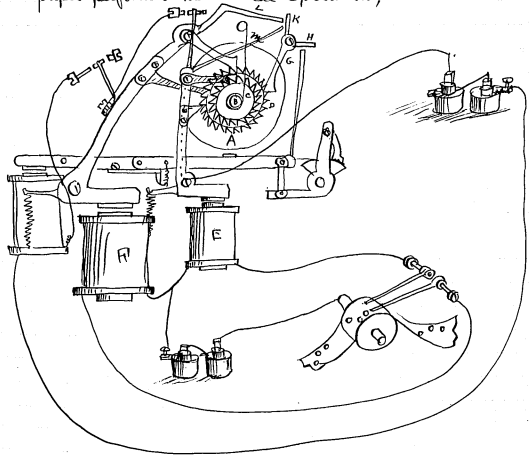
now describe

Date of written between July 31 and Aug 4 1871

Witness — for T Murray T A. Edison

A new system of Telegraphy, using neither dots nor dashes, but receiving the message by a Puncher or Embosser and Running it through an automatic Translating Printing Machine I do not wish to confine myself to any particular Translating Printing Machine, as I have innumerable machines in my Mind now which I shall continue to Illustrate & describe day by day when I have the spare time,

The Printer which I propose to use for translating from the punched or embossed paper, is as follows though I may improve it in time or adopt an entirely new one using Magnetism or dispensing with it and make the paper perform a mechanical operation,

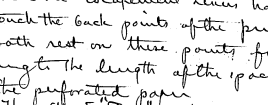


A is the type wheel B its shaft C is a small rotatial wheel rotated by E Magnet armature lever pawl & detent, and D another rotatial wheel rotated by the magnet F Armature lever check & detent, the first magnet E pushing the type wheel ahead one letter

and the magnet F. 4 Letters, G is a pawl for preventing the type wheel from returning to Zero which it would do by the action of the rubber cord M secured to its shaft, The Printing Throw this detent out of the path of the rotatel when it takes an impression When this takes place the type wheel returns to Zero, This click is placed back in its original position by the first forward Movement of rotter rotatel Lever operated by the Magnet.

The Printing Lever is jointed near to fulcrum and held to the other part of the lever by a tension, and when the magnet attracts this Lever the forward part goes further by its momentum than it would if the Lever was actuated slowly and in so doing effects the impression and immediately springs back out of the way of the type wheel, and at the same moment when the lever has reached its extreme Limit, the click G is thrown out of the rotatel and the Cord M pulls the type wheel back to zero The circuit of the type wheel rotating Magnets ~~and~~ is opened a closed by perforated or Embossed paper. The characters being in two rows, one row rotating F The type wheel 4 Letters at a time and the other but one Letter at a time, the 4 Letter Magnet & devices might be dispensed with but the characters of the perforated paper would be too Lengthy, The Printing Magnet is closing when the both Escapement levers have ceased to work and touch the back points of the pinning Cranks They both rest on three points for an interval according to the length of the space between the Letter on the perforated paper

To translate The Word "This" The perforated characters should be Letters = The holes in Line No 1 rotate the type wheel 4 Letters for Each one and as T is the



20th Letter 5 dots are used when the space between the

Letter Comes this gives the Escapement Lever time enough to close both points & close the pinning Lever & effect the pitch of that Letter,

The Letter H being the 8th Letter but 2 holes are necessary the Letter I being the 9th Letter in the Alphabet 2 holes in Line No 1 turn the the type wheel to the 8th Character & one hole in Line No 2 one more Letter bringing it to I. S being the 15th Letter 4 in the upper Line bring it to 12th Character & 3 in the Lower to the 15th which is S', 3 rows of holes Could be used but it would be hard to transmit them over the wire,

The Device for Running the perforated Embossed or otherwise prepared paper through may be a Drum Carried by Magnetism Weight Spring & any other free or free-stopping device,

There are several ways by which this translating paper may be prepared by an instrument operated by similar paper at a distant station.

first 1st = An Electro Magnet may have a very delicate Valve fitted to its armature Lever and this Valve operated a cylinder & piston worked by Compressed air or other force or power, and the piston of which has a punch Like a belt punch, Cutting upon a block of Leather, Rawhide or Compressed paper ~~and~~ at every hole punched feed the paper ahead, or the punching may be done while the paper is being fed Continuously by other means, The Magnet should be a polarized one working two valves & pistons one Cylinder & piston punching or Embossing holes in one Line & other other

piston in another line, which line being determined by the polarity of the current, the paper might be dispensed, the lever of an ordinary morse Register being operated by the cylinder & compressed air or Chemical paper might be used, the decomposed portion being of such a character that by immersing it in another substance an action would take place to form a salt or other matter & so raise the character in relief - which could be made to raised a very delicately poised lever & open & close the electric circuit = of the translating Printing Machine or an Ink Recorder could be used the ink of which would be a conductor and two points closely together & connected with either end of a battery & magnet the mark would also connect the two points together or the ink could be a Chemical & dipped in some solution like that which I proposed to dip the Chemical paper,

Above written Aug 31 1871

T A. Edison

Witness, Jos T Murray

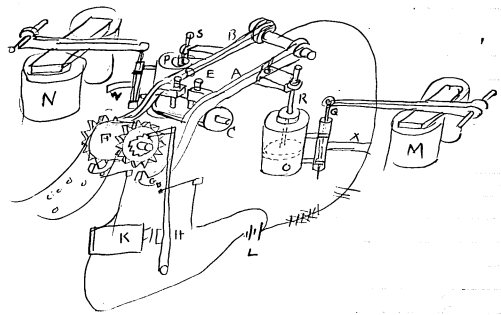
Or the ink of the ink recorder could be mixed with a sticky or gummy substance and just at the moment the recorded characters were made by the Roller a fine spray of hard substance could be thrown upon it it adhering to the ink and raising it in relief, Sand, flour Emery, Pumice Stone, Sugar, or some hard substance of a porous nature, having an absorbent power & ground fine could be used, or the ink might contain an acid or chemical substance which would burn eat or rot holes in the paper,

or a lead pencil might be used instead of the ink roller and the plumbago mark would be made to close an circuit having a very high resistance

Battery in it, or the end of the magnet lever might have a fine needle and prick holes in the paper and the burr which would be thrown up on the other side be made to close a circuit by means of lifting a delicately poised lever,

or a sharp groove might be cut in the paper carrying drum ~~and~~ in which the roller having a sharp edge would just fit, and tissue or other thin paper being used when the roller came down it would enter the groove and show the paper

I will now explain my Compressed air receiver

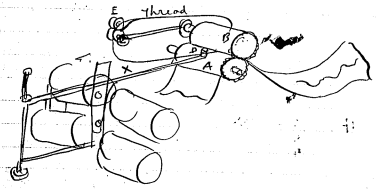


A & B are the levers having ordinary belt punches putting on a raw hide surface or roller C

S & E are the punches, F is the paper feed drum have two V shaped ratchet wheels the end of levers A & B having wedges which throw the paper forward after it is punched

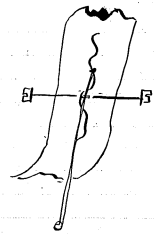
K is a magnet having a lever H which is provided with a pawl working a ratchet on the paper feed drum F, thus ~~as~~ to

feed the paper ahead between the two Letters
The two levers A & B being provided with closing
points so that when both levers are at rest the
close the Circuit through this Extra Magnet,
But when operating they do not stop at the Contact
point long Enough to allow the Magnet to act
owing to the tremendous rapidity with which
the levers act, O P are the air cylinders the Valve
being operated by the main Line Magnets, one
Magnet responding to Negative Currents and the
other to positive Currents,
I do not wish to Confine myself to any particular
form of Air Cylinder or Valve, I merely claim
Punching paper or Embossing paper by
Compressed air controlled by Magnetism,
also positive & negative Currents for doing same
thing, I have been experimenting this day upon
a novel idea by which the paper may be Embossed
at a tremendous rapidity & requiring very little
power to Control it,
I do it by means of and Endless Chord,



A & B are two rollers rotated by power and closely held
together by immoveable bearing ~~and~~ & Carried
around by gear wheels, One Roller is very hard

substance and the other soft, The paper passes between these
rollers, and with it a Hard thread, or watch chain, This
thread or chain in passing through these rollers
with the paper of Course the thread or chain is impressed
to full depth in the paper, and leaves an endless
embossed or raised mark upon the paper, This
Chain or thread is Endless band like, and the
Thread passes through a little hole on a head
at the extreme end of the armature lever X at
D, E is a guide roller for guiding the chain
and worked by gears or other device, from the
roller A. B. so that the thread or chain will always
be stuck where it passes through the point on the
magnet lever, The Characters are formed by
guiding the thread either one side or the other
When a loop either one side or the other is
thus made the rollers seize the thread and
immediately indent this loop in the paper, This
paper after being prepared has a follower with
a point the point running in the groove
and of Course giving a back & forward motion
to the lever which closes a circuit Each time
it passes to the right and clog another in passing to
the left, Thus



Though this may be done in many other ways
The Characters being made to lift a lever
or two levers & closing the circuit that way

This chain band or thread might be wound around the roller itself and a slight slack made, to allow of making characters the thread guided by a fork from the armature lever of the Electro or polarized Magnet,
or the roller could have two flanges at its end higher than itself and innumerable little wires passing from End to End around the cylinder so free to move endwise these little wires could have teeth on them two teeth on each end when in their normal position these teeth would form two continuous wheels but if the armature lever should throw one of the little bars forward the of the teeth would indent out of line & thus form a character, A Cam on the other side of the roller would throw the rod back in position after the impression was taken

Sept 4. 1871

7A Edison

Witness Jos. F. Murray

The ink used in the Ink Recorder, or any recorder which I may adopt could be of a gummy nature, and as quick as The Record should have been made it could be quickly Covered with gold leaf or ultra alemunlid metal or very fine metallic dust could be mixed with the ink or thrown on after the record was made - Instead of the Thread or chain for embossing after the manner described Sept 4 1871, The armature Lever might be a tube ~~within~~ and placed at an angle and Continuously fed with very fine Shot or round, or small substances these could be near the two rollers a stopper, and the End of The tube when in its normal position would rest against this & thus prevent the shot from Rolling down the tube, if now the armature Tube is deflected to the right the shot run out are Caught between the two rollers & the paper and they are indented in the

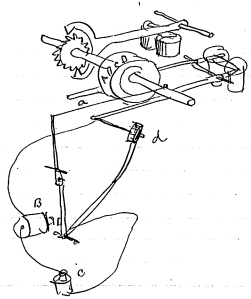
paper, and when deflected to the left the shot roll between the rollers in another line, These indentations Can be made to close & open an electric circuit in Connection with the printer, the mechanism Which rotated the Indenting Rollers ~~etc~~ also Carries the shot back to ~~f~~ Be fed through again,

At the present writing I am inclined to believe that I am the originator of the idea of using perforated paper for controlling or working printing Telegraphs

Sept 15

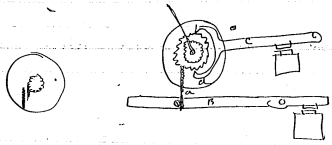
Witness, Jos. F. Murray Thomas A. Edison

On page 24 I describe a printing Machine by which the type wheel returns to zero Every time a letter is printed, I will now describe Second way in which it Can be done,

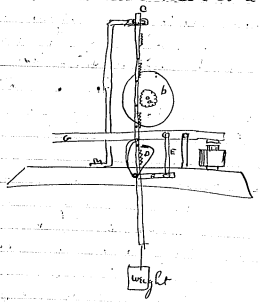


B a magnet a a Cord d wires break When the type wheel has been rotated to proper position the printing Lever Come

up effect the printing & as the Amount in the relay & the Relay lever goes forward tightens up the Cords and pulls the Wheel & shaft back to zero again!



a a rack B printing Lever C Escapement lever d type wheel when printing Lever goes up rack goes into teeth Cut in shaft and throws it back to zero which is a limiting pin.



G the printing lever b the type wheel a the shaft with teeth Cut in it C an intermittent rack pulled downward by a weight and released by the printing lever moving the pallets S by and of bar F and link E thus pallet

release pins on side of C. The action of this mechanism is easily seen.

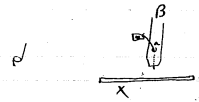
Janey 30 1872.

Thomas A. Edison

Witnessed

Jos. F. Maurey

Hollow Cutting Punch Manner of getting rid of the Chips thus



B the punch X a rawhide pad on which the Cutting punch B cuts a a small hole through which a wire (small) runs this wire being stationary. When the Punch moves down and Cut a piece ~~it~~ from the paper this pad in the punch which in Coming up the wire punches or shoves it out. =

I have another device by which the punch or Cutter when it Comes on the paper presses hard and turns around thus Cutting it out after the manner of a Knife =

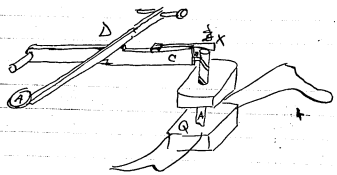
Mrs Mary Edison My wife Dearly Beloved

Cannot invent worth a Damn! !

Feby 1 1872 T A Edison

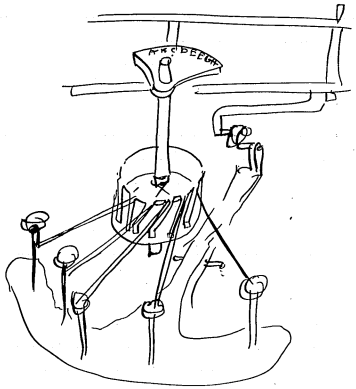
Perforating Apparatus:

The mention consists of a set of cutting wires or punches which press on the paper and turn around at the same time by the action of the levers worked by the keys and a steady pressure kept up by a spring on the key bar thus



D the key C the punch lever or key bar A the cutting punch which has a spiral groove cut in it like a twist drill into which groove a tit from the key bar C runs X is a spring When the key is depressed the key bar C is depressed the spring X letting the top of the punch A bring it down on the platen of raw hide Q & on the paper and the downward motion of the bar C and the tit rotates the cutting punch A and cuts a round hole in the paper after the manner of a knife or hole y shear I have only shown one punch, hem and punch of the nine The spiral groove in the punch A might end near the top and a spring attached to the punch

A to pull it down on the paper when the lever C is depressed but the tit on this bar would lift the punch up off of the paper when at its normal position as the spring on the bar C would be much stronger than that on A.



Printing Machine X Crown ~~and~~ wheel with Cam slots depress a key rows type wheel around in right place Lever hits platen four points, described to Ringer

Feby 2 1872 J A Edison

Nov 12 1874 Experiments with Weiss Galvanometer

Ferrocyanide of Pot when bent or rubed wet or dry on surface gives no current

Pure stick zinc when bent or rubed gives no current

Peroxide of Manganies crystals gives A very sensible current

Peroxide of Manganies crystals connected to copper and Platine electrode very sensible current when held in hand but not when cold seems to show thermo electrick properties

With tin electrode about the same

Nickle very strong

Steel " weak

copper electrode gives a reflection

Aluminum " " " "

cadmium " " " "

could discern no ~~electricity~~ current by rubing two pieces of cadmium together

cadmium and steel electrodes in bottle of black oxid

Manganies dry gave a reflection equal to one

cadmium and Platine ½

" " Tin ½

" " Nickle ¼

" " copper one the other way

" " Aluminium ¼ " "

" " Pure zinc 0

Antimonic acid when rubed or bent gives no current

feebledly dry bump

But placed between copper and platine electrode gives a strong current, tin and copper a current one other way Nickle and copper a current

cant detect no current from the bending of hardrubber

Chas Batchelor

Tellurium.

July 27th 1874

Protochloride of Tin precipitates metallic Tellurium in a finely divided state as a black powder.

Hydrosulphuric acid of Ammonia precipitates Tellurium in black powder as a sulphide

Batchelor

Sep. 9th 1874

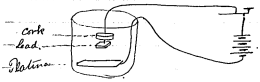
Pyrogallic Solution

for what purpose	Water	Pyrogal.	Salt
for a number of thicknesses of paper	20 ℥	11 grains	2 oz.

Scales. E-1677 -
p.128 telegram from Edison. Sept. 3.
Meff for Gomestic Tele.
M.C.B.

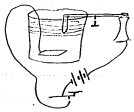
Experimental Philosophy.

1. Aug. 3 1874.



See if H evolved on the Lead will decrease its specific gravity
Solution Caustic Potash.

2.



See if it dies when circuit is open.

Bat will be in action
Bat in action

1. 12 cups of battery used. Bunsen.
Cork raises slowly but is entirely due to mechanical means so much H collecting under the lead as to considerably lessen its weight. Acts slow. Satchelor. Aug 3 1874

Satchelor
20 lb
different exp.

August 4 1874

Aniline, Water, ~~Nitrate~~ Mercury Nitrate
Iron pen smooth on Oxygen, Thallium best.
But without Aniline Mercury Nitrate alone gives
black or brown mark with Iron pen —
Added Nitrate Soda or Potash to increase
Conductivity — Chloride precip Mercury
White paper
With Aniline Carmine shaken with Chl
Sodium & Fuming Nitric Acid, Iron
pen gives a pale carmine color on O,
becomes deeper after exposure. It has
a bronzing appearance in Mercury
— Yellow paper

Cadmium 8 W

4 Cells Metals used P 7a Nickel Cu Sn Pb Brass

Herbal Extract

Dwarf Elder

Oxygen Hydrogen

Nacl. Carbon Zinc

all-

Dwarf Elder ~~carbon~~ zinc with platina very pale yellow mark, very inferior, not sensitive. —

do with Nitric A — nothing.

Henbane. Platina or Zinc yellow pale inferior quite, but better than Elder. Iron or Carbon inferior.

Garden Nightshade.

Nothing on any

Comfrey Root

Nothing on any

Solomon - Seal Root

Nothing on any

French Thyme

Fair but inferior yellow mark with Platina or Z comes out better after while might do for short account.

Chickweed

Nothing on any

Plantain Leaf, X

Nothing on any

Turkey Corn Pea

Nothing on any

Celery Root

Nothing on any.

Thunderweed

Nothing on any

Motherwort

Nothing on any

Bogenbitter Lice - Platina to zinc pale yellow - inferior - Iron to Zinc inferior - Carbon nothing.

Sweet Elecampane

Nothing from any

Wild Cherrie

Nothing from any

Dandelion Herb

Nothing from any

Meadow Sage

Nothing on any

Pearberry Leaf

Nothing on any

Wild Carrot Flowers

Nothing on any

Asparagus Root

Nothing on any

Rough Scrap Chaves - Platina on zinc very pale yellow - very inferior - Carbon nothing

Rosewood Flowers Platina to Zinc - Low yellow

Princess Pin Platina to Zinc - very Low yellow

Garden Balm

Nothing on any

Hemlock Bark

Nothing on any

White Pond Lily Root

Nothing on any

English Smart Weed - Copper to Zinc - very poor yellow.
Pink leaf Pyrola Platina to Zinc very poor yellow.
Wormwood
Nothing on any.
Fair Cat Moss
Nothing on any
Arnica Radical leaves
Nothing on any
Cocash Herb Steel to Carbon - very black mark - Zinc nothing - Steel mark indistinct at first - but gradually becomes distinct -
Dandelion Root
Nothing on any.
Heal all
Nothing on any -
Young Cedar
Nothing on any.
Raspberry Leaf
Nothing on any
Wild Lettuce Steel to Zinc very poor dark mark.
Red Maple Bark Steel to Carbon - black mark - faint at first - black after - very poor.
Red alder Bark Platina to Zinc - at first a faint mark which gradually becomes a kind of a bright "hard maroon" Iron to Carbon very poor black
Ailanthus
Nothing on any -
Yarrow Platina to Zinc faint yellow
Steel to Carbon pale black
Gentian Root Steel to Carbon very faint black mark

Balmony - Platina to Zinc very faint yellow mark. Steel dito.
Rattle Snake Plantain
Nothing on any.
Pussy Willow Buds
Nothing on any
False Bitter Root Bark
Nothing on any.
Marygold Flowers
Nothing on any
Sweet Flag Root
Nothing on any.
Sarsparil
Nothing on any.
Nettle Root
Nothing on any
Maiden Hair Fern Platina to Zinc very slight yellow - Steel to Carbon poor black mark
White Pine Bark
Nothing on any
Nerbeers Blue
Nothing on any.
Cotton Buds
Nothing on any
Mayweed
Platina Zinc poor faint yellow
Cedar Berries
Nothing on any
Oak Leaves
Nothing on any
Burdock
Nothing on any
Blue Cardiac Flowers
Nothing on any
Catnep Platina vs Steel to Zinc both give very slight & poor yellow marks

Wild Indigo Root
Nothing on any
Parsley Root
Nothing on any
Rue Herb Platina & Zinc - slight opaque yellow - Steel & Carbon inferior
Dock Root
Prickly Ash Bark
Nothing on any
Sumac Bark Root
Nothing on any
Poke Root Platina & Zinc Opaque
"Sticky" yellow
Mare foot clover Platina & Zinc fair yellow
Club Moss Nothing on any.
Apple Mint. Steel & Carbon. poor black
Mark - Platina & Steel & Zinc faint yellow
Sunflower Seed
Nothing on any.
Foxglove Brown & Zinc, Sticky yellow

Aloe antm. Nacl mix on P.
" Nacl NO_3 mix on P

Chl Mang P. on O fair
" Nacl. bottle

Cadmium Chl (phyrogal)
P. on O. light yellow not very good.

Juniper Berry
Nothing on P.

Frostwort.
very faint yellow P on Zinc

Sweet fern
quite sensitive yellow P on H
pyro improves it to same
added Brazil W. very nice

Gall of the Earth
nothing

Sweet Bugle
Mullein Root Slight yellow P on H
Slight yellow P on H

Chestnut bark
slight drank
P on H,

Life root.
Nacl VERY SENSITIVE P on H
pyrog dont improve but marks very pale yellow

Brazil W & nit am. red mark spreads painfully (acrid) not a kills it Enlarge dont mark

Arnica Root P on H
Nacl Pale yellow but sensitive

Trad flux no good
Soap root mix
Cornell grass mix
Water Hemlock mix
Beach bark
made 1/2 fair P or H
Ozm good, its
the Tannin in it

Red clover head
Very Seas - but extremely
pale yellow

Chestnut leaves,
Very pair - almost good
P or H but its the
Tannin

Brat many no good
In Chl Calcium Ha Cl - unsalizable
Chl Lithium no good
Valerianate Zinc no good
Chl Strontia something in it
Very good made

Nitrate of Prot Mercury. Nitric acid
neutralized with Ammonium Hydrat
or Potassic Hydrat. Then add
Rosanilin. Then Salt, filter. Use
Sensitive. Tropen —

Nitrate prot mercury.

Continued

also Chl Cadmium
something in it good
made =

Rhodant Ammonia
good - try it more

Edison
Patchett
Adams
Fox
Long
Charley } 12

Edison.

Chemical Experiments Lora. Sensitive & permanent solution March 8th 70

Metals Used. Iron. Indium: Bismuth - Magnesium. Cadmium. Cromium. Aluminum Antimony. Palladium. Zinc. Tin. Lead. Copper Ruthenium. Lithium. Thallium. Arsenic. Nickle. Platina. Molybdrum. Osmium. Uranium. Rhodium Silicum. Zirconium - Manganese. Silicium. Vanadium. Coed. Bismuth. Scale of battery used Sact - Edison.

Nitrate Magnesia - Nothing on Zinc Carbon - ~~Platina~~ a slight black mark Platina on Zinc Carbon - a yellow mark with Ruthenium on Zinc - try again Indium Manganese on Zinc - not very sensitive black mark - a light yellow with Palladium on Zinc.

Nitrate Magnesia - Sact Batch

Nitrate Ammonia & Nit Magnesia - nothing on Carbon blackish mark on Indium on Zinc.

Sact & Nitrate Magnesia Batch - Manganese Prussian bright red mark on C - try again Edison. Nitrate Amonia & Nit Magnesia. Ruthenium on Zinc - quite sensitive. Try again.

Nitric Acid & Nit Magnesia on Carbon. Nothing. Zinc. ditto. Indium black mark fades - no good.

Nitrate Amonia & Nit Magnesia - Carbon - Batch Sensi - Faint black mark. good.

Sact & Oxalate of Strontia Carbon. Edison - nothing nothing on Zinc

Nitrate of Amonia & Oxalate Strontia. Carbon - Edison - Nothing - Zinc Ruthenium. try again. Indium not very sensitive try again.

Nitric Acid - Oxalate Strontia Carbon - nothing. Zinc Nothing

Acetate of Lime - Sact - Carbon. Edison - six - Zinc nothing - ditto Nitrate Amonia - Carbon Nothing - Zinc Indium fair - black mark

Batch

Nit Amonia & Nit Magnesia Carbon - Batch Manganese Bright Red mark try again.

Nitric Acid & Nit Magnesia Carbon. Osmium black mark fades out - ditto Manganese very bright red mark try again. ditto. Bismuth black mark

Oxalate Stronta & Nitric Acid - Carbon Manganese - bright red mark try again - ditto Carbon - Sensi - faint black mark.

Acetate of Lime - Nitrate Amonia Carbon - Manganese bright Red mark try again.

Batch Over

Acetate of Lime & Nitric Acid. Carbon. Rosting.
Ditto Zinc - Indium Slight fader.

— " —

Acetate of Baryta & Met. Carbon. rosting - Zinc nix -

— " —

Ditto & Nitrate Ammonia - Carbon rosting - Zinc Indium fair - try again. Palladium fair try again

— " —

Ditto & Nitric Acid. Carbon Rosting - Zinc Palladium marks slightly. Ruthenium Slightly

— " —

Manganate of Potash & Met Carbon. rosting - Zinc Ruthenium Slightly

Ditto & Nit Amonia - Carbon nix - Zinc - Indium & Ruthenium Slight.

Ditto & Nitric Acid. Carbon rosting - Zinc Ruthenium Slightly

Ditto & Nit Amonia.

Sulphite of Soda & Met Carbon nix. Zinc Ruthenium & Palladium - Paly fair -

Ditto & Nitrate Amonia Carbon nix - Zinc Ruthenium & Palladium slightly

Ditto Nitric Acid. Carbon nix - Zinc Cobaet mark very insensitive

Bisulphite of Soda & Met Carbon rosting Zinc Palladium Slight.

Ditto & Nit Amonia Carbon rosting. Zinc Ruthenium & Palladium Slight.

Ditto & Nitric Acid - Carbon - nix. Zinc, nix -

— " —

Sulphate Stronta & Salt - Carbon Zinc Ruthenium & Palladium very slight - fader

Ditto & Nit Amonia Carbon nix - Zinc Ruthenium & Palladium Slight

Ditto & Nitric Acid. Carbon - nix - Zinc Ruthenium & Palladium very Slight =

Oxalate Stronta & Met. Rosting on Carbon, or Zinc

— " —

Acetate of Lime & Met Carbon. Manganese bright red mark. Zinc rosting

Ditto & Citric Acid - Carbon - Manganese bright red mark try again. — " — Zinc - rosting.

Acetate of Baryta & Nitrate Amonia - Carbon Manganese bright red mark - ditto - Silver dull black mark

Ditto - & Met. Carbon Manganese bright red mark - Zinc Rosting.

Ditto & Nitric Acid - Carbon. Manganese bright red mark - Zinc rosting - also Silver dull black mark on Carbon - fader out. —

Manganate of Potash & Nit amonia. Carbon - Silver - black mark. Manganese red mark - Zinc nix — " —

Ditto & Nitric Acid. Zinc - Zirconium - black mark but fader instantly - Carbon - Manganese bright Red. Silver - black mark — " —

Sulphite of Soda & Met. - Carbon & Zinc - nix

Ditto - Nitrate Amonia - Carbon & Zinc nix

Ditto & Nitric Acid. Zinc nix. Carbon. Manganese bright red. — " —

Bisulphite of Soda & Met. Carbon & Zinc - nix.

Ditto & Nit Amonia Zinc. Zirconium black mark - try again. Manganese on Carbon - red mark very poor

Ditto & Nitric Acid. Carbon - Manganese bright red mark - Zinc nix

Sulphate of Stronta & Met. Carbon. Manganese bright red marks. Zinc rosting

Ditto & Nitrate Amonia - Carbon - Manganese very bright red mark. Silver - black mark - Zinc Rosting.

Ditto & Nitric Acid. Carbon Manganese bright red mark - Zinc rosting

Edison

Protochloride of Tin & Sact. - Carbon & Zinc mix -
Ditto & Nit Amonia " " " nothing of
any Consequence.
Ditto & Nitric Acid. Carbon mix. Zinc Indium
Midding - fade out.
Sulphate of Zinc & Sact. Carbon mix. Zinc nothing
of any Consequence
Ditto & Nit Amonia. Carbon mix. Zinc nothing
of Consequence
Ditto & Nitric Acid. Carbon mix. Zinc nothing
of Consequence. — " —
Pyrogallic Acid & Sact. Carbon Platina Slight.
Iron Slight. Indium Slight. Litium marks without
a comment. Zinc nothing of consequence
Ditto & Nit Amonia - Zinc & Carbon - nothing of
Consequence
Ditto & Nitric Acid. Carbon - mix. Zinc Ruthenium
& Palladium are to best yet. Try again.
— " —
Valeriante of Zinc & Sact - Carbon & Zinc mix -
" " " & Nit Amonia. Carbon & Zinc mix
" " " & Nit Acid. " " " "
Nitrate of Allagania & Sact. Carbon - mix - Zinc mix -
" " " & Nit Amonia - Carbon mix - Zinc Ruthenium
Slight.
Ditto & Nitric Acid. Carbon mix. Ruthenium & Palladium faint Zinc
— " —
Hypochloride of Lime & Sact. Carbon mix. Zinc Cobaut
Bully - red hot - black. black permanent try
again.
Ditto & Nit Amonia, Carbon mix - Zinc cobaut
dont mark.
Ditto & Nitric Acid. Carbon mix. Zinc, Indium fair
but fade.
Acetate of Copper & Sact Carbon & Zinc mix
" " " & Nit Amonia " Carbon - nothing of
Consequence - Litium marks without Carbon.

Batchelor

Protochloride of Tin & Sact. Carbon & Zinc mix
" " " & Nit Amonia. Carbon - phenomenon
Silver - brown mark. ~~Cant make more than a~~
~~mark if you draw too slow.~~ best seen on
Silver so far.
Ditto & Nitric Acid. Carbon Manganese Red
mark. Good on Carbon. medio b - mark. Silver
on Carbon good. Zinc mix.
— " —
Sulphate of Zinc & Sact. Carbon. Manganese
bright red mark. Zinc mix.
Ditto & Nit Amonia. Carbon. Silver black mark.
Manganese bright red mark. Osmium black
mark when worked very slow Zinc mix.
Ditto & Nitric Acid. Carbon. Manganese bright red mark.
— " —
Pyrogallic Acid & Sact. Zinc, Molybdenum brown
mark. Osmium brown mark - ~~try again~~ Lithium
brown mark. Manganese brown mark. Lithium
brown mark. Vanadium brown mark. Good brown
mark. Silver ditto. Carbon. mix
Ditto & Nit Amonia -

FOR EXPERIMENT

Phenomenon.
Pyrogallic Acid & Citrate Amonia. Marks
black with Silver - doesnt appear at
first - after an instant dense black.
Silver & Carbon. If the Silver is first
Conquered & Zinc no mark is made
but if it is then put to Carbon & soon
one has mark it makes an instantaneous
curly black mark. Extraordinarily
Sensitive. Nitric Acid & Pyro. Sact
& Pyro. do not produce the ~~phenomenon~~
with Sact it marks on Zinc in the
usual way. with mixture of Sact & Nit
Amonia marks on both Zinc & Carbon

Edison

Citrate of Potash & Sact - Carbon & Zinc mix
" " " & Nit Amonia - Carbon mix. Zinc
Indium quite sensitive & permanent.

—"—

Lactate of Zinc & Sact Carbon & Zinc mix -
" " " & Nit Amonia. nothing of consequence on Elec.

—"—

Nitrate Magnesia
Oxalate Amonia & Sact. H2O. Nothing
Ditto & Nitrate Amonia H2O mix
" Nitric Acid. H2O mix

—"—

Acetate of Lime & Acetate of Baryta & Sact H2O. Mix
" " " & Nit Amonia H2O. Mix
" " & Nit Acid. H2O "
Sulphite Soda
Nitrate Potash } & Sact. H2O mix
" " & Nit Amonia. Carbon Ruthenium & Palladium
fair - Zinc mix
Ditto Nitric Acid. Carbon - Ruthenium & Palladium fair

—"—

Bisulphite Soda
Sulphate Sesquioxide } & Sact - H2O. mix.
Ditto & Nit amonia H2O mix.
" " Nit acid H2O "

—"—

Sulphite Zinc
Protoxide Zinc } & Sact - H2O Mix.
Ditto & Nit Amonia. Indium on Carbon very Sensitive
by again
Ditto & Nitric acid H2O mix

—"—

Valeriate of Zinc
Pyroglelic Acid } & Sact & Nit Amonia. H2O. Mix.
Ditto & Nitric Acid H2O "

—"—

Hypoclorite of Lime
Nitrate Magnesia } & Sact. Carbon. Cobaet bally.
Ditto & Nit Amonia H2O. Mix
" & Nit Acid. " "

Batch

with Amonia Hydrate. no good. Defined
Solution should be mixed with this for Experiment

—"—

Valeriate of Zinc & Sact. Carbon. Manganese bright
red mark - Zinc mix
Ditto & Nit Amonia. Carbon. Manganese bright red.
Zinc - mix.
Ditto Nitric Acid. Manganese bright red mark.
Zinc mix

—"—

Nitrate Magnesia & Sact. H2O Mix
" " Nit Amonia - Manganese Carbon
good red mark - Silver black - no ~~of~~ Zinc mix.
Ditto - Nitric acid. Carbon Manganese bright red
Zinc - mix

—"—

Hypoclorite Lime & Sact. Carbon. Manganese
bright red mark - Zinc nothing
Ditto & Nit Amonia. Carbon Manganese bright
red mark. Silver black.
~~Ditto & Nitric Acid~~

—"—

Acetate of Copper & Sact Carbon Manganese
Red mark Zinc mix
Ditto & Nit Amonia. Carbon - Phoenomenon
Manganese Red mark. Silver black - Zinc mix.

—"—

Citrate of Potash & Sact. Carbon. Manganese
Bright Red Mark. - Zinc mix.
Ditto & Nitrate Amonia. Carbon. Manganese
Bright Red mark. Zinc mix.

—"—

Lactate of Zinc & Sact. Carbon. Manganese
Bright Red mark. Zinc mix
Ditto & Nitrate Amonia. Carbon Manganese
bright red mark. Zinc mix.

Edison

Hypo phosphate of Manganese + Sulf. H+O. Nix
Ditto + Nit Amonia. H+O. Nix

Formate Amonia + Sulf. H+O. Nix.
" Nit Amonia. Carbon. Ruthinium
+ Palladium fair. R. best yet

Phosphorus Acid + Sulf. H+O. Nix
Ditto + Nit Amonia. [illegible]ting. R. Ruthinium
fair.

Bromide of Manganesium + Sulf. H+O. Nix
" " + Nit Amonia " "

Chloride of Uranium + Sulf. H+O. Nix.
" " + Nit Amonia H+O. Nix

Bromide Potassium + Sulf. Platina on Carbon a faint
yellow mark
" " Nit Amonia. Carbon Ruthinium most
sensitive yet. Try again

Bromide Mercury + Sulf. H+O. Nix
Ditto + Nit Amonia. Zinc Arsenic very sensitive
Try again. Yellow mark

Sulphate of Cellorphia + Sulf. H+O. Nix
" " + Nit Amonia " "

Tung State of Amonia + Sulf. H+O. Nix
" + Nit Amonia H+O "

Batchelor

Hypo phosphate of Manganese + Sulf. Carbon. Manganese
Red mark - multiply disappears. Zinc. Nix
Ditto + Nitrate Amonia. Carbon. Mang. Red
Mark Melancholy disappears. Zinc Nix.
Carbon Silver Black Mark

Formate of Amonia + Sulf. Carbon Mang. Red
Mark Zinc Nix.
Ditto. Nitrate Amonia. Carbon Ruthinium + Pall.
zinc fair Ruthinium best yet. H+O. Nix

Phosphorus Acid + Sulf. Carbon Manganese
Red mark Zinc Nix.
Ditto + Nit Amonia. Carbon Manganese
Red mark Silver black mark Slight.

Bromide of Manganesium + Sulf. Carbon. Mang. Red Mark
Ditto + Nitrate Amonia. H+O. Nix

Chloride of Uranium + Sulf. Carbon Mang. Red Mark.
" + Nit Amonia " " " " "
Silver Black on Carbon.

Bromide Potassium + Sulf. Carbon Mang. Red mark.
" + Nit Amonia " " " " faint

Bromide of Mercury + Sulf. Carbon Mang. Red mark
Ditto. Nit Am. Mang. Red Mark.
Silver faint on Carbon.

Sulphate of Cellorphia + Sulf. H+O. Nix
" " Nit Amonia. Manganese Carbon. Fair Red

Tungstate of Amonia + Sulf. H+O. Nix
" " + Nit. Amonia. Carbon Mang. Red
Mark. Zinc Nix

Edison

Acetate of Lime + Sact. H+O Mix
Ditto + Nit Potash H+O Mix

Cyanide Potassium + Satt. Carbon. Cobaact
Quit sensitive try again

Ditto + N Potash. H+O. Mix

Hyposulphite Sodium + Sact. H+O Mix
Ditto + Nit Potash. H+O. Mix

Sulphate of Cadmium + Sact. H+O Mix
" " " + Nit. Potash " "

Nitrate of Uranium + Sact. H+O Mix.
" " + Nit Potash " "

Pyrogallic Acid + Hyposulphite of Soda. H+O. Mix
Ferrocyanide Potassium
Nitrate Uranium + Sact. H+O. Mix
Ditto Nitric Pot. Coaact Carbon good try again

~~Phosphoric acid~~
Formate Amonia
Phosphorus acid + Sact H+O. Mix
Ditto - Nit Potash " "

Chloride Uranium
Bromide Magnesia } Sact H+O. Mix
Ditto. Nit Pot. " "

Bromide of Potassium
Mercury } Sact. Arsenic on Zinc
Ditto - Nit Potash. Iridium on Carbon
Arsenic on Zinc - Comparatively Sensitive

Tungstate Amonia
Sulphate Morphia } Sact. H+O. Mix.
Ditto Nit Potash Ruthenium on Carbon
Bair.

Bakelor

Acetate + Lime + Sact. Carbon Clang Red Clands.
Ditto. Nitrate Potash. H+O. Mix.

Cyanide Potassium + Sact. Carbon Clang Red Marks
Zinc Nothing
Ditto + Nit Potash. Carbon Clang Red Marks.
Silver black.

Hyposulphite Sodium + Sact H+O Mix
Ditto + Nit Potash. H+O. Mix

Sulphate of Cadmium + Satt Carbon. Clang Red Marks
" " + Nit Potash. Carbon " " "

Nitrate of Uranium + Sact. Carbon Clang Red Marks
" " + Nit Potash. " " " "
Silver on Carbon black.

Pyrogallic acid Hypo of Soda H+O. Mix.

Ferrocyanide Potassium
Nitrate Uranium + Sact. Carbon Clang Red
Ditto Nit Pot. H+O. Mix.

~~Pyrogallic acid~~
Phosphorus acid
Formate Amonia } Sact. H+O. Mix.
Ditto. Nit Potash. Carbon Clang Red.
Silver Slight black marks

Chloride Uranium
Bromide Magnesia } Sact. Carbon Clang Red.
Ditto. Nit Potash. Carbon " "
Silver Slight black

Bromide of Potassium
" " Mercury } Sact Clang Red on Carbon
Ditto. Nit Potash. " " " "

Tungstate of Amonia
Sulphate Morphia } Sact Carbon Mangled
Ditto Nit Potash - H+O. Mix

Edison

Acetate Lime
~~Cyanide Palladium~~ & Sact. Carbon Ruthenium fair
Ditto Nit Pat. H+O Nix
— " —

Sulphate Cadmium
~~Hyposulphate Sodium~~ & Sact H+O Nix.
Ditto. Nit Pat. H+O "
— " —

Stannate of Soda & Nit Pat. H+O. Nix
" " Sact. H+O. "
— " —

Chloride Cadmium. Sact. H+O. Nix
Ditto Nit Pat. — " — " "

Tartaric Magnesia & Sact. H+O. Nix

" " & Nit Pat. H+O "

Sulpho Cyanite of Mercury & Sact " "
Ditto & Nit. Pat. " "
— " —

Reperino & Nit Potash. H+O Nix
" & Sact " "
— " —

Sulphate Cerium & Sact. H+O. Nix
" N. Potash. " "
— " —

Arsenate of Amonia & Sact. Nix
" " " & N. Potash " "
— " —

*Chlorat Antimony & Sact. Ruthenium on Carbon
quite ~~cancelled~~ - more so than anyone for -
Platina marks very small on Carbon - Magain.
~~Rosenow Grow~~ Bully - Red - Not - Chlorat Antimony
Nitrate Potash Platina Marks
Fair on Zinc. Experiment with it.
— " —

Uriate & Amonia & Sact Nix
" & N Pat "

Batchelor

Acetate Lime
~~Cyanide Palladium~~ & Sact. Carbon Mang Red
Ditto Nit Pat. H+O Nix
— " —

Sulphate Cadmium
~~Hyposulphate Sodium~~ & Sact H+O Nix
Ditto Nit Pat " "

Stannate of Soda & Nit Pat. Carbon Mang Red.
Zinc - nothing.
Ditto & Sact. Carbon Mang Red marks.
— " —

Chloride Cadmium & Sact - Carbon Mang Red - marks.
Ditto Nit. Pat. " " "

Tartaric Magnesia & Sact. Carbon Mang Red.
" " & Nit Pat. Nix -
— " —

Sulpho Cyanate of Mercury & Nit Pat. Carbon - Silver
not very good
Ditto & Sact - no good.
Reperino & Sact H+O. no good
" & Nit Pat.

Sulphate Cerium & Sact.
" " & N Potash. Silver on Carbon.
— " —

Arsenate of Amonia & Sact Nix
" " N Potash Nix
— " —

Chlorat Antimony & Sact *Dont forg ~~chlor~~ Chloride or chlorate. marked Carbon Manganese Red.
Ditto & N. P. Good on Zinc & Manganese
black mark on Zinc

Goder little fisher

Uriate of Amonia & Sact. Nix
" & N Pat. Nix

Edison

Phosphate Soda & N Pot Mix
1. " Sact "
— " —

Chloride Manganese & N Pot - Platina on Carbon very slight.
" " & Sact. No. Good.
Glacial Phosphoric Acid & Sact - no good
Dito & Nil Pot — " " "

March 10th Experiments on Pyrogallic Solution and Silver Nen. Chloride combines with Pyrogallic show no reaction with Silver - Phosphate of Potash & Nitrates show the reaction. Nitrate of Ammonia, better than Nil Silver. It is the hydrated base which does the business. Pyrogallic. Nitrate Soda in small quantity - Caustic Potash just sufficient to turn the solution a deep yellow - when well shaken gives the most delicate results with Bedly for short circuit - the marks are black staining about on 10.000 Ohm a slight mark of considerable delicacy is obtained readily no good is gained. The paper has a light brown color, to a solution of Pyrogallic acid & Phosphate of Potash a very small quantity of Caustic Potash is added, there will be a white precipitate or milkiness & the solution does not become colored. Caustic Potash is to be added, but not enough to re-dissolve the milkiness, further the liquid becomes colored. Paper dipped in this milky solution is white, although the marks are not so deep a black as some of the Pyrogallic Solutions the loss of Equal Sensibility after the paper has become dry. There are as black as any, this appears to be a 1st class solution. Patent

Batchelor

Phosphate Soda & N Pot Mix
" " & Sact. Many faint red Carbon.
— " —

Chloride Manganese & N Pot. Many red Carbon
" " & Sact - Mix.

Edison 13
Batchelor 13
Mans 13
F & 13 low
Chalby

March 10th 1895 Edison

Sulphite of Magnesia + Sact No good
Ditto + Nit Pot — " — no good

Sulpho Carbol Soda + Sact. nix
Ditto + Nit Potash — " — nix

Chromate Potash + Nit Pot. Platina on O extra faint yellow mark.
Ditto + Salt. Nothing but Iron on O. red mark fair
— " —
Sulfoniate Sodium + Nit Pot. nix
Ditto + Sact nix.
— " —

Acetate of Zinc + Sact. nix
Ditto + Nit Pot. nix
— " —

Acetate Magnesia + Sact nix
— — N.P. nix

Bromhydr Natrium + N Pot. nix
Ditto + Sact " "
— " —

Borate of Mangan + N.P. nix
Ditto + Sact "
— " —

Hydrar-g Acetic + Sact. nix
Ditto + Nit Pot. Platina slight. hydrargum
— " —
Hypophosph Iron + N Pot. nix
Ditto + Salt "

Caffeine + Sact nix
Ditto + Nit Pot "
Chlor Propylamin + Sact nix
Ditto + N P "
Wild Indigo + Salt nix Ditto + N.P. nix
Canada Thistle + Sact nix Ditto + N P nix

March 10th 1895 Batchelor

Chromate + Potash + Salt. Silver Red mark metallic
Chromium - initially disappears.
Ditto + Nit Potash. nix.

Batch got
Nothing on any of the Solutions
on the opposite page
Batchelor

Edison

Wild Bergamot & Salt Platina on A.
good yellow. Iron fair
Ditto & N.P. - nix

Sodium Sesquitannin. Pyro acid & Sact - Platina very good.
Ditto & N.P. Silver & Platina. both mark on A

— " —

Pyrophosphate Iron & Sact & Pyro gallic - Platina on A very fair.

Acetate Mercury & Pyro & Sact. Platina good on A.
All the previous list with Pyrogallic no good.

Platina only
March 16th 1895

Lactate of Iron & Sact - nix.

Acetate of Strontia & Sact - nix

Oxalate Cobalt & Sact - nix

Carbonate of Bismuth & Sact - nix

Ptlor

Oxalate of Copper & Sact nix

Lupeline & Sact - nix

Nitrate Zinc & Sact - nix.

Phosphate Lead & Sact - nix

Oil Sassafras & Sact nix

Bachelor

Wild Bergamot & Sact nix
" " & N.P. "

Edison
Batch
for
Agaro
Charly
12

March 16th 1895.

Lactate of Iron & Nit Soda - nix

Acetate of Strontia & Nit Soda - nix

Carbonate & Bismuth & N.S. - nix

Oxalate Copper & N.S - nix

Lupeline & N.S ~~Soda~~ nix

Phosphate Cad & N Soda - nix

Oil Sassafras & N.S nix
Microcosmic Sact & N.S "

Acetate Strontia & N.S "

Edison

Micro Cromate + Sact mix.

Chlor Lead + Sact mix

Chlor Stronta + Sact mix.

Bromide Cadmium + S. - Bellyon Electromalograph

Chlorate Zinc + S. - good on " "

Oil Wintergreen + S. mix

Marck 6th. F. + C. E.

Logwood Chips + Sact very sensitive P to H

Pyrogallic acid + Ferrocianide Soda + Sact. Black Mark - Platina Co. - Fair

Ferrocyanide Potash + Sact Red Fok on Iron.

Bachelor

Chlor Lead + NS - Mix

Iron Chlor. + NS - mix

Bromide Cadmium + NS. Really out for Electrotype

Chlorate Zinc + NS good on "

Oil Peppermint + NS - mix.

Chlor Barium + Chlor Nickle Sact - Mix

" " " + NS. "

Chlor Bromine Chlor Nickle + Sact Black Mark on Zinc - but wont mark on the Bromine heavy tissue paper. Marks after made are permanent

Bromide Potassium Chlor Nickle - Black mark on H. wiped out by Oxygen.

Brazil wood, after trying some 15 26 28 42 981 different solution of Brazil wood were come to the conclusion that it is not worth a damn Sodis Paladium Chloride being the only one that was worth anything.

Lavender Flowers & Sact. nix.

Purslane & Sact. nix.

Low Cadweed & S. Pow N. faint yellow mark.

Arbor Vitae & S. nic.

Squaw Vine & S. nic.

Peruvian Bark & S. nic

Purple Pitcher Plant & S. nic

Flowers Moss & S. Pow N. faint yellow mark.

Sassafras Bark of Root & S. nix.

Poke Berries & S. nix.

Arnica Flowers & S. nix.

Mountain Mint & S. Pow N. faint yellow.

Shagbickory Bark & S. Pow N. - good yellow mark

Red clover Heads & S. nix

Shagbickory Bark & Nit Soda. Pow N. bright yellow mark.

Horse Radish Root & N. Soda. Pow N. - yellow mark

Elder Flowers & S. nix

Stramonium Root & N.S. nix

Blue Skull Cap & S. nic

Wild Indigo Leaves & S. nic.

Buckhorn Bark & S. Pow N. red mark fair.

Sassafras Leaves & nix

Samphire & S & N Soda. nic.

Lizard Tail Root & S. nix.

Mullein Leaves & S. "

Mountain Mint & N Soda. Pow N. faint yellow

Tamarack Leaves S. nix.

Beech Drops & Sact nic

Whiter Poke Root & Sact. nic

Elecampane Root & Sact. nic

Rockey Top Grass & S. nic

Chamomile Flowers & S. nix.

Rosylock Flowers & S. nix.

Coppyleaves & Flowers S. nix.

Bachelor Button & S. nix.

Burdock Leaves & S. nic

Abscen Root & Salt. Nic

Skunk Root & S. Nic

Nerve Root. Valerian & S. Nic

Mullein Leaves & S. Nic

Queen Meadow Root. Nic

Wild Cranes Bill Root & S. Nic.

Malt & S. Nic

Am. Hellebore Root & S. Nic

Scabious & S. Nic

Climbing Bittersweet Berries & S. Nic.

Sulphate of Iron & Salt. no good.

Tannate of Zinc & Salt. " " "

Fer Chloret acetylsalicyl acide & Salt. Gallic - very sensitive on O.

Elaterium & S. No good.

Chloride Barcum & Salt. nix

Hydrang Oxydat. Flav. & Salt. nix

Proto sulphate Iron - Nitrate Soda - Pyro - & ~~Nit Soda~~
Nitrate Uranium. Bneln Red. Hot
Edison Paraffin Carbon For chalky 13 hr

Electro Motograph

Nit Soda. Fer Chlor & Salt
Platina to Zinc friction increased.
Enormously - splendid - very good mark
on H. would answer for stock machine

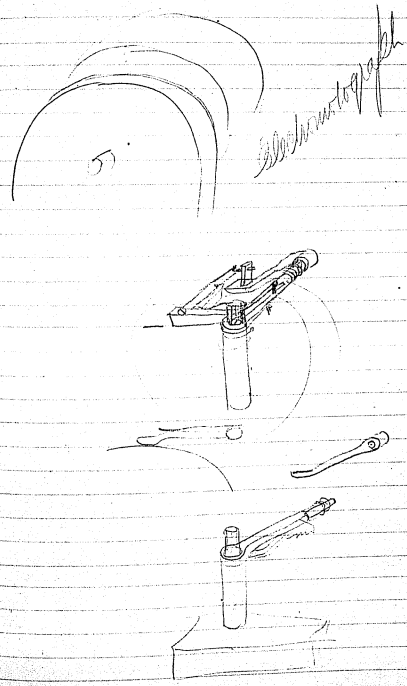
Sulph Cy Potassium - Nit Potash - Nit Lead
Chlor Soda. marks without a current violen
current comes on from silk pile stop
mark.

Clfe - Nit K. Tannin - Nit Ar Tannin
ChlNa Hypo Na —
Beautiful strong deep black Post
Neg white Brown Blue of
Equal delicacy may be
useful

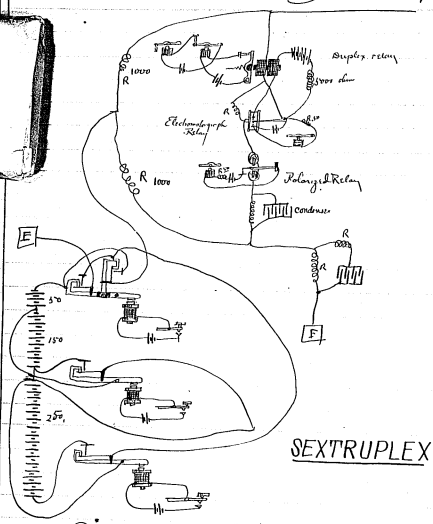
Electromotogh

Oil Sweet Almonds
Clfe Na Cl - Plat on
H friction Enormous
greatly [illegible]

Edison 12


Electromotograph

August 20 1875



SEXTRUPLEX

Edisons Sextruplex Telegraph

By this apparatus three messages may be transmitted in one direction and three in the opposite direction all at the same time over one wire, I send positive and negative currents from 100 cells to effect the movement of the lever of a polarized relay at the distant station and transmit one message and increase the strength of the current by the addition of 150 cells extra to effect the lever of a Duplex Common relay (ie) a common relay with two coils of fine wound on to cores, to transmit a

second message, I then add 250 cells more over the 150 to move the lever of my Electromagnetic Relay to transmit the message

The addition of the 250 cells is prevented from working the duplex relay by having the lever of the Emg close a local circuit in which is a battery whose current circulating in the extra coil on the duplex relay balances the current from the 250 cells. The lever of the Emg moves very much quicker than ~~that~~ a magnet no jump is noticed =

Written & drawn
August 20th 1875

In the above drawing I have shown the Emg with a single lever for currents of one polarity. It should be thus :—

so that it responds equally to reversed currents

Aug 20 1875 =

Aug 5 74

Aniline Solution

Best so far is Aniline, Chl Zinc, Nitric Acid to which is added Chl Iod, will do without this.

Citric, Tartaric & Acetic acids added to the Chloride & Nitric Acid work well, Chloride Lime dont work, Mercury Nitrate & Aniline with Nitrate Ammon for Conductivity fades but its nearly as sensitive as Iodide, Both the Aniline Sols alone & Mercury & Anilines Coagulen are more sensitive. The dress chl paper is Glacial Phosphoric Acid, Salt, Nitric A dont work well, Glacial Acetic A added improves it slightly.

It wont do to use too little aniline,

Aniline Nitr Bmg April 5 74

Quinine Sulph. N.O. Chlsod, Hyd Ammon.

marks with tin pen on Hydrogen acid, Platina shows Edsons N.F good on both. Tin on Hydrogen side shows well, The tin pen marks black but its not so very sensitive, Lead pen is most sensitive, N.F. shows splendid on this solution, Extra Good I think on account of the lead being reduced & giving a mark I think this is necessary for that purpose that the lead, should be reduced to get sensitiveness, though platina shows it on short clct it went on 10000 ohm & 6 Cells Carbon while Lead is fearful thing,

Aniline, Excess. lime water, boiled for some time & then filtered hot, Yellow Solution, No marks but Lead shows extraordinary strength N.F. better than Quinine above, I find on trying Palast that it is as good probably more sensitive but above appears to act sharpest and cleanest, paper smoother, I added salt to Cost, but no marks obtained,

Edsons Patchett adams Fine charly 1/2 f. 6-74

Alcohol & Nitric A with little water splendid with Lead N.F. thank it best, the longer the Solution effervesces the better it gets, - tried another do 1/2 hour better yet - tin pen did much best, Oxalic or Caustic K Kill it almost entirely - bad for Iodes too,

Aniline N.O. Hydrochloric A Blk Ox Mang followed pretty good green fore - ~~Fine~~

Alcohol & Nitric A. too much Acid decomp N.F. suddenly immense nitric fumes NF none, with lots alcohol with A. NF the very strongest,

Aug 7th 1874 4 AM.

Pyrogallic Acid with salt & lead pen very sensitive on Hydrogen & pen. White paper & blackish brown mark. Paper seems to be less sensitive as it is taxt. all pens mark in Hydrogen also except silver.

Excess of Chl Na & Pyrogallic acid seems to be best

Auto sensitive even when small amt of Pyrogallic Ac is used

Chl Zinc kills it entirely

N H4 added to Salt solution no good.

Seems to be exceedingly sensitive to 'New force'.

Platinum marks on this but not as sensitive as lead which seems to be the best.

Platinum also gives on O side a not very sensitive pale yellow mark

Changed the Instrument here Platinum & Iron drum

Pyrogallic Acid & Citric Acid do mark at all in any pen

Pyrogallic Acid & Nitric Acid & Salt lead marks on small resistance & very good.

Gallic acids mark something like the same as Pyrogallic

Here last it seems may be due to the metallic drum on which they were tried as we changed it from Platina & Iron.

witness Batchelor

See Page 162

Edison

New Force Electromotographs

Alcohol no good

Alcohol + HO " "

Sulphide Potassium " "

Fluid Sol. appears to be very good

Operated & recorded with Electromotograph (900) three hundred words per minute

10000 ohms & 6 cells of Carbon

with ordinary Fluid paper & that rather dry. with lead & a point.

Also tried winding several layers of paper round the drum but impracticable. Put a piece of paper under lead & kept it there constantly impracticable. Shunted Instrument with battery two both ways apparently of no use. The new machine with double spiral spring adjustments is a success much better than the other one gone to P.O.

We tried if the mere passage of a current produced the force by making a bow of the lead but it did not.

Phosphorus Water No good.

39 Continuous hours work

Batchelor witness

Adams

Charley

Edison

Aug 4th 1874 6 p.m.

Relative Delicacy

The Pyrogallic & Gallic give very sharp writing but they lack delicacy they will make very nice salts for short circuit work & are not as yet of sufficient delicacy for long circuits they probably can be made so by further experiment. Excess of salt as yet seems to be the best for them

Solubility of Gallic although slight appears to give as good results as the more soluble Pyrogallic

Oxalic acid added 1 Rg Ferrid which Prussian blue is said to be insoluble did not increase the delicacy of reaction nor alter the characteristics of marks but somewhat whitened the paper

Nitrate Mercury & Amm. Nitrate (chlorides form ppt.) gives a delicate solution on pen on O with small normal tall it is a little more delicate than Pyrogallic but not of a very permanent character. Could some compound be put in the paper in which the mark is insoluble it would be a valuable addition

When combined with Aniline red or Magenta which was previously oxydized by Nitric acid & decolorized greatly increases the sensitiveness of the paper it is then more sensitive than regular Ferrid with little normal tailing (2m pen on O) as yet we have not succeeded in making it very permanent More delicate than all these solutions is Aniline red or common Small

crystallized Magenta the proper name of which is perhaps Hydrochlorate of Rosaniline. This readily dissolves in water forming a deep red or carmine with extraordinary coloring properties

By adding to the solution in water a certain quantity of the red forming Nitros Ac. the aniline becomes oxidized & made nearly colorless.

In this solution is added a small quantity of vegetable ac the action of which I do not clearly understand of Tartaric Citric Acetic & Oxalic acids the latter of which is the most sensitive & gives the best writing

Lip pen is used on O

The action of which is that the O forms a peroxide ~~or perhaps~~ which is one of the best known reducing agents & that portion of the decolored oxidized aniline in the immediate vicinity of pen is reduced to deoxidized & its original color which is red at first but by contact with air it becomes colorless

The marks are very permanent the sensitiveness nearly equals if not quite Iodine. The defect of this ink is that the marks are so faint at first that they can scarcely be seen in fact at first they are not at all visible. This defect we shall probably be able to get rid of

A Combination of Pyrogallic with Gallic & Chl. Sodium gave no better results

Edison

Saturday Aug 9. 74

N Force,

24 parts NO 24. Nitric A. 24
Alcohol, to which added little nitrate
Silver - supposed to make fumbling
silver, Lead shows nothing on O or H,
but platina shows on O only.
Silver gives faint mark big at first thus on O.
— .... — — — — Silver shows
Nf on O + tin, -

Alcohol. Stannous Chloride, Nitric A.
no marks no Nf. - also NO added
Nf -

Tannic Acid + Salt. Nf very powerful
Cadmium work but not so strong as
Lead. it appears to be more powerful
than dryest ferro reg -

Permanganate Pot, is not bleached
or marked by any pen 14 nr. O,

Tannic A no mark with
6 cells on 10,000 ohms lining
perf paper 50 words per min

Edison 12
Batchelor 12

per Chl Iron, Ferricyanide Pot,
platina pen on H. H reduces
perchl to protochl + ferro solution
a blue - Must have platina drum
or paper gets bad, gives about
same delicacy as singular ferro,
might be made with varying ferro Iron

Another Equally good Ferro &
perlosul Iron, ought to be
perlo-chl iron, & chl Sod.
platina pen. Make protochl a
higher or + ferro solution
blue -

Electromotograph: the force is not increased
by putting the instrument in a magnetic
field or magnetizing the drum or magnetizing
the point of iron.

New Solution Good more delicate than reg
ferro, Platina pen = O. Protosulphate
Fe, Tannic Acid + Nitrate Ammonia, all of
which want to be concentrated.
Distilled water best.

New Solution. (Phenomenon extraordinary)
Pyro gallic Ac Protosulph Fe Nitrate of
Ammonia. More delicate than the
Tannic Ac Sin pen on H. Delicate
when just touched the paper but no
mark with pressure
Platinum the same shape, than sin
pen delicate may with slightest pressure
Delicate with lead and slightest pressure

Gallic Ac. Nitrate Amm + Prot-
- sulphate Iron is not so delicate on
short circuit ~~as~~ long circuit about the
same marks with same pen
Batchelor 12 Edison 12.

Aug 10th 1874

Catechu solution no good
Catechu with Chl Sodium gives mark
but not very good
Catechu Chl Sodium + Prot sulp Iron
mark but not very good

Sumac solution no good
Sumac + Salt gives mark on short
circuit but not delicate black mark
on nearly white paper
Silver also marks on Hydrogen in this
solution
All pens mark on short circuit
Sumac + Salt + Protosulp. Iron no good
Sumac + Nitrate of Ammonia no good
but marks of course short circuit

Walnut shucks + Salt mark on short
circuit but not very sensitive
Walnut shucks + Salt + Pyro gallic Ac.
not so good as Pyro + Tannin
Walnut shucks + Salt + Sulph Iron
no good. but marks.

Yellow Aniline dyed worst with
Salt Nitro Ac or Pyrogallic acid

Butternut shucks + Salt mark but not
sensitive on H with lead, Zin + Tellurium
No particular marks on O
Butternut shucks Salt + Proto sulph Iron no good
Sulph Iron kills butternut shucks.
Butternut shucks + Tannic Ac no good Tellurium
very black on short circuit
Butternut shucks salt + Phosp Ac. no good.

Madder solution Salt + Protosulph Iron
Good marks on sht ct not sensitive
Madder + Salt + Cand Pot. Tel strong on sht ct.
but not very sensitive
Madder + Nitrate Ammonia mix
sh ckt good
Madder + Nitrate + Potash no good. (Ckt sht ok.)

Fustic + Salt Tel. lead + Zin + ~~Iron~~ good
sht ckt on H Iron good sht ckt on O.
Tellurium good on H about equal to Tarred
lead does not mark good on Fustic in fact
very inferior.
Hematic, Salt + Pyrogallic good on sht ckt
Tellurium rather sensitive
Fustic Salt + Nitrate Am no better.
Fustic + Walnutshucks Tel pretty good not as
good as Fehid
Fustic + Tannic Acid Salt + Chl Iron every
pen marks on H but more on O + more as
sensitive as Tarred thing. Tellurium good
Tried also Chl. Gold but no better.
Edison 12 Batchelor

Aug 10th 8 pm 1874.

Walnut chucks after standing a day seem to be much more sensitive for Selenium on H. other pens good on chk chk.

Aug 11th 11 pm 1874

Ruthenium.

Ruthenium pen on O

Salt no good.

Ordinary Ferro paper which is bleached white & nearly dry was the first on which we received marks these marks were received in 6 cells 3 of through 3 water rheostats 1 Bradley Rheostats & 2 feet of wet hemp string, saturated with Ammonia

Sulphide of Amm. + H_2O. No good

Alcohol + HO. no good

Ferrocyanide Pot. gives blue on short chk. but light yellow + quite sensitive on 3 HO Rheos, addition NaCl dont help it much

Sulphocyanide Pot. No good except dry + on 1 Rheo in chk out —

Mixture NaCl, + Ferrocy with it no good.

Sul Quinine Hy Am + Na Cl. No good. noticed that if allow pen stop on paper little it sticks to it, though 3 Rheos, may be something in that.

Sulphurous acid No good.

Neutral Nitrate + Ammonia Hydrate No good.

St Sulphydric acid no good

Ferrid alone. yellow very sat val. very fair, try again

Permanganate KO, bleach on H. something on O. try again

Sulphate Zinc through the 3 Rheo: + 1 Bradley gives dot when you put pen down + it gives the same as often as you just the pen down but it is only on the first closing of current.

Nitrate Cop on H good.

Salt added to Sulphate Zinc makes it no better.

Following No good, Stannous Chl. = Au Cl. Phosphorus NO, Sul Magnesia – Sul Soda Hypodulphite Soda – ~~Nitrate of~~ = Nitrate strontia, Nitrit Lead, – Sul Ammonia Cupro sulphate, Citric A, Tartaric Antimony, Plumbic Acetate, Nit Soda, Acetate Soda, Sul Manganese, Gum Arabic, Acetate ~~Ammonia~~ not good, Stearic Acid, Carbonic Acid, Anemonic Acid, Hydriodic not good = Car b Soda Nitrate Mercury. Phosphowolframic a Chromic Acid, Formic Acid Stearic Acid, Salicinic Acid, Oxalic A, Anemic A Anemonic Acid Antimonic A – Boric Acid, Iodide KI – Borax, Arsenate Ammonia, Gallic A, Bromide KO, Bichromate KO – Sulphuret KO, Sul KO, Permanganate KO, Benzoic A, Ferricyanide KO, Acid KO Tartrate, Bitartrate Potash,

Aug 12th 1874 Chem. Decom.

Indigotic Acid Sulph. Indigo & Salt are good & Protochlide Iron no good
Salt & nitro Acid No Good.

E. A. Ph. 24hrs

Aug 13th 1874

Spark Induction Current:—

1. When you put one end of Secondary into fine brass filings & then dip the other wire into them & steadily lift it away from them a thin thread of filings follows & sticks to the wire. This thread we drew out to 2 inche. It seems as if the filings were soldered together for the time With Iron filings I got about ¼ inch of the filings were lighter we might get more Powdered Carbon will not do it at all I rather repels if anything.

Aug 21 1874

~~Decomp~~ Protchloride Iron & Sulphocyanide Put in the soluble red Sulphocyanide of Iron in a test tube. The one of the magnet dipped. This was surrounded by a 6 ohm spool with 6 cells Battery it produced a precipitate after about 3 hours.

~~The difference~~ Two tubes in which a slight cind of Sulphocyanide of Iron was one of which was placed within a Bradley spool & 6 cells battery. The cind within spool diffused itself immediately while the other took some time.

Aug 12 1874

12.

Aug 21st 1874 Automatic

I find that Pyrogallic Acid & Salt are no good except on a platina drum On iron drum decomposes the paper & does not give a good mark at all even in sht ckt but when Platina drum is used lead is very good on sht ckt that kills it for 'domestic' uses.

Pyrogallic & Salt & Beef extract no good
Beef & salt all pens mark on ⊕ lead especially black but fades away to a brown almost immediately.

Beef & Salt & Tellurium Pen fine black mark on sh ckt but not very sensitive to H.

Chas. Batchelor 12hrs.

Batteries Aug 25 74

Zinc, Carbon, Pure Sul. Ac outside, ~~HO~~ HO slight + Blk ox Mn outside acts like a Condenser, on closing get a momentary strong Current which very quickly ceases, under this appears to be a very weak but permanent Current addition of H O to outside increases strength but little,

Aug 25 74

Sal Ammonic Carb + Zinc in + out quite strong & steady for 1 hours, tried it no longer, added Oil Turpentine which weakened it,

Aug 25 74

Carbon NaCl, HO, Tellurium no current or Founder apparently.

Edison 8hrs

Pyrogallic Acid Salt,
Contaminate Metal. 'Phenomena'
Tin better than lead on
'Electromotograph'!
Platinum & lead good on H. for
chemical bd. all pour much N H
Pyrogal. Salt. Antom Pot. Sulphate of Iron
dark purple paper Platina & Tin bleaches
on H, lead & Tin Brown marks on O.
Strychnine Salt & Sulph Ac exceedingly
sharp black marks with lead on H

Sulpho Cyanide Mercury & Chloride Ammonium
No good on Silver Lead Platina Tin. probably
insoluable.

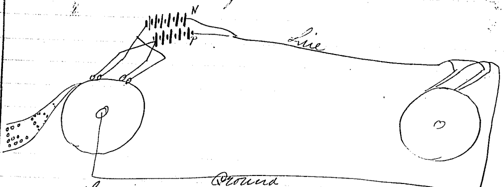
Aug 26th 1874.

Received from J.A.B. for Analysis.
Some Ore from Relief mine Utah
(Black) Sulphurets of Silver

Some Ore from Fuller mine Salt Lake
(Yellow) Chlorides of Silver

Sep 7th 1874

Made experiment of Roman letter with one wire with the two instruments & O.K. we also found out that the extra dots could be blotted out by Caustic Potash the connections for it are thus



The two rollers that transmitt the bottom of the letter are set more than a full letter behind the two top ones in order to get off the letter before the other ones get on. Two batteries are used you send a positive & neg. current on the 3 & 4 pen which are recorded on all four & the same on 1 & 2 which record on all four ~~& the way they can be distinguished~~ thus: in the word 'this' T H I S when you send on 3 & 4 it commence on T & makes the two bottom dots but the two top pens make also two dots but which are ahead of the other two so:- (: :) now when you send on 1 & 2 3 & 4 also marks but behind but the two top marks meet the bottom ones in the right place & the consequence is there is the same amount of dots between the letters as the letters themselves (: T :) in the next letters the extra dots lap over these so in the word 'this' (T H I S) Now blot out the extra dots & you have the word (T H I S) If you take the strips when they are still damp they are very easily erased

by Caustic Potash weak. this of course is with ordinary ferrid sol.

Chas Batchelor

T. A. Edison

Cost of Inst. 35.00
C.B. 12th

Experiments to blot out the marks made by
Blot on Pyrogallic and salt And Logwood and salt

Sulph Antimony	No Change	No Change
Antimonic Acid	"	Turns it same color as
Sulphate Pot	Yellow color	Black color
Manganese Chloride	No Change	Dark blue color
Sulphs cyanide Pot	"	No change
Gamboge	"	"
Tartarized Antimony	"	Dark blue color
Stannous Chloride	"	
Oxlate of Iron	"	No Change
Zinc White	"	"
Sulphate Calcium	"	
Aniline	"	Blue
Naphthaline	"	No Change
Nitrate Nickel & P	"	"
Sulphuret Calcium	"	"
Carbonate Zinc	"	"
Sulphate Indigo	"	"
Rochelle Salts	"	"
Arsenious Acid	"	"
Gum Ignorach	"	"
" Senegal	"	"
" Arabic	"	"
" Mastic	"	"
" Camphor	"	"
Nitrate Soda	"	"
" Copper	"	"

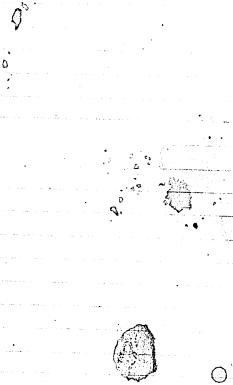
Low Partaw
10.4

Sep 14-1874

Electronitograph. Palladium drum think will be very good, with lead

Mercurie Nitrate, Aniline, & Nitros Acid
Platina on Platina is as good as lead on platinum & not thought to Alle better.

Iron drum seems better.



Sulphonaphtalic Acid
shows new force on lead on O strongly
also works well Iodat in it

Sulphoxonic Acid shows NF on O. with lead
very strongly =

Sulphomethylic Acid " " " "
when reduced with Potassic Hydrat it is
stronger than Sulphoxonic

N 7

Messlers Reagent = Not am
platinum per good — pbly the
mercury that does it =

Experimental Research

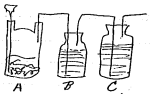
Aug 3 (1874)

Sulphate of Quinine dissolved in H_2O
No mark for O or H
in Iron, Thallium, Silver, Copper, Lead
Zinc, Aluminum, Platinum Cadmium
Sulphate Quinine dis. in KO_3 with
Chloride of Ammonium
No mark with H or O with the above metals
Sulphate Quinine dis. in Ammonia Chloride
Gave no mark with above metals on
either side when mixed separately with
Oxalic Ac Hydrochloric Ac, Carbonate Copper
Bichromate Potast, Sulphocyanide Potassium
Sulphuric Ac, Ferrocyanid Potassium
Nitrate Cobalt. Edison

Aug 4. 1874

Sulphide of Iron ($Fe\,S$)
Made this from bar Iron heated to a
white heat & pressed against a bar of
Sulpher over a water bath into which
it drops after combination with sulpher
It is brittle & has a look slightly bronzed
Batchelor

Hydrosulphuric Acid ~~& H~~



Made this in the following way
A contains Sulphide Iron ($Fe\,S$)
& dilute Sulphuric Acid ($HO\,SO_3$)
strong chemical action in
which Sulphuretted Hydrogen (HS)
is given off. which passes through the bottle B
which only has water in it & wash the gas
& from that into the bottle C filled with
distilled water which is impregnated with
Sulphuretted Hydrogen (HS) The gas after leaving
bottle C would smell obnoxious, & in order to

prevent this we pass it into still another
bottle containing Ammonia Hydrate ($NH_4O\,HO$)
which combines to form Sulphide of Ammonium
(NH_4S). The chemical change which takes
place in first bottle is shown by the
following:—

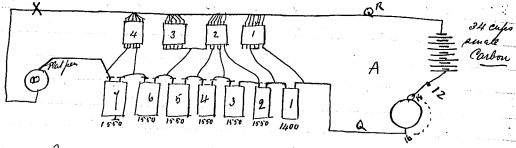
$$\underbrace{Fe\,S}_{\text{Sulphide Iron}} + \underbrace{HO\,SO_3}_{\text{Sulphuric ac.}} + \underbrace{H_2O}_{\text{Water}}$$

$$\underbrace{Fe\,O\,SO_3}_{\text{Sulphate Iron}} + \underbrace{H\,S}_{\text{Sulphuretted Hydrogen}} + \underbrace{H_2O}_{\text{Water}}.$$

Batchelor.

Cable. Sunday night May 2nd 1875

No 4 Solution



No 4 Condenser only 2 on end nearest receiver

Sample 1 Ten words per minute.
5 + 6 Condensers put in at X
Sample 2 Ten words per minute & turned uneven
Sending shunt from Q to Q R of 500 Ohms. Sample No 3.
5 + 6 Condensers out at X Samp. 4
Shunt A only 200 ohm Samp 5
Shunt A only 100 ohm Samp 6
" " " 50 ohm Samp 7
Leak of (3000) ohms between Res 2 + ground 8 Samp.
10 " " 2000 " " " " " " 9 Samp.
11 " " 1000 " " " " " " + 500 a
Shunt A
12 " " 2000 " " " " " " + 500 a shunt
13 " " 3000 " " " " " " + 500 shunt
14 " " 2000 " between bet. R 2+3 + 500 Shunt
15 " " 2000 " " " " " " "
16 " " 1000 " " " " " " "
17 " " 2000 between Res. 3+4 " " " "
18 " 2000 " " " " " " "
19 " 1000 " " " " " " "
20 " 2000 Between Res 4+5 _____
21 2000 " " " " _____
22 1000 " " " " _____
23 3000 Between Res 5+6 _____
24 2000 " " " " _____

25 Leak of 1000 ohms Bet. Res. 5 + 6 + 500 ohm shunt
the marks on this are only known by the increase
decrease of pitch Electromotograph principle
26 800 ohms plugged at in each Rheostat leak placed
between 1 + 2 of 3000 ohm.
27 ditto leak 2000 ohm
28 ditto leak 1000 ohm
29 Leak placed bet 2 + 3 Res. of 3000 ohms
30 " " " " " " " 2000 ohms
31 " " " " " " 1000 ohms.
32 " " " 3 + 4 " 3000 ohms.
33 " " 2000 ohms.
34 " 1000 ohm.
35 " " " " 4 + 5 " 3000 ohms.
36 " 2000 ohms.
37 1000 ohm
38 1 leg of magnet in each resistance box put in
+ without leak R.
39 ditto with leak R bet Res 1 + 2. 3000 ohms.
40 " " " " " " 2000 ohms.
41 " " " " " " 1000 ohm.
42 " " " " " " 500 ohm
43 " " " 3 + 4 3000 ohms.
44 " " " " " 2000 ohm.
45 " " " " " 1000 ohm.
46 " " " 6 + 7 " 3000 ohms.
47 " " " " " 2000 ohms.
48 " " " " " 1000 "
49 Leak off full magnets in all boxes 500 a shunt
50 Leak between 1 + 2. 3000 ohm.
51 " " " " 2000 ohm
52 1000 ohms
53 " " 3 + 4 3000 ohms.
54 2000 ohm
55 1000 ohm

Magnets all out.

No 1
2
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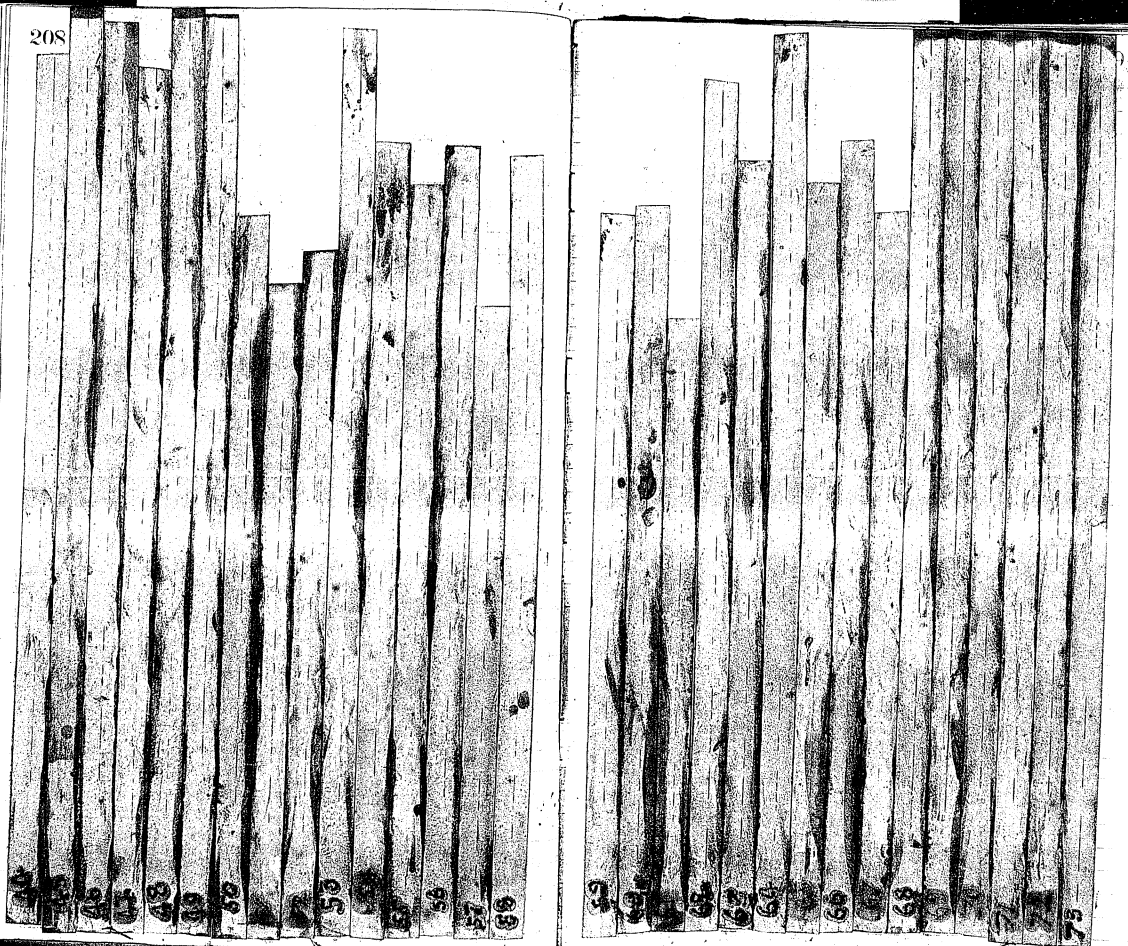
56 Leak containing 3000 ohms + 200 ohm magnet
with armature on core between 1 + 2 500 ohm shunt
57 " " 2000 ohm " " " "
58 1000
59 " " " 3000 " " " between 3 + 4
60 2000 " " " "
61 " " 1000 " " " "
62 " " 3000 " " 6 + 7.
63 2000 6 + 7
64 " " 1000 6 + 7
65 Leak between 2 + 3 3000 ohm + 200 magnet
Leak between 5 + 6 1550 oh + 200 magnet
66 Leak bet. 2 + 3 2000 ohm ditto
67 1000 ohm ditto
68 All rheostats have 750 ohms in 500 ohm shunt
Crank speed up + turning steadier on leakers
69 Ditto without shunt.
70 Ditto with 400 ohm shunt
71 Ditto " 200 ohm shunt.
72 " " 200 oh "
73 " " 100 " "
74 " " 100 " " Double speed
75 " " 100 " " 50 words per min
gone back to old speed 8 words per min
76 " " 100 " "
77 " " 50 " "
78 20 " "
79 10 " "
80 " " 200 ohm mag. in shunt
81 " " " " " " 50 wds per min
82 " " " " 750 res " " 8 wds per min.
83 " " " " 100 " " " " "
84 " " " " 200 " " " " "
85 " " " " 400 " " " " "
86 " " " " 800 " " " " "
No 5 Condenser taken from X connected round shunt
87 " 200 oh mag + 800 res in shunt
88 " " 400 " " "



89 " " " 200 oh mag 200 ohm res in shunt
90 " " " 100 " " "
91 " —— 200 oh mag only
92 " " " " " " Condenser off
Condenser 5 inserted at 12
93 " " " 200 oh mag only in shunt
94 " — 200 " " 800 " " shunt
Condenser at 12 shunted with 2000 ohms
95 —— 200 mag & 800 res in shunt
96 200 mag. magnets shunt off all together. ~~Condenser shunt~~
Condenser shunted with 2000 ohms
97 800 res. in shunt
Condenser shunted with 1000 ohms
98 800 res. in shunted
Condensers 5, 6, 7, at 12
99 ~~Same in shunt~~
100 Condensers 5, 6, 7 shunted with 3000 ohms.
101 " " " " 2000 ohms
102 1000 oh
103 Condensers 5 6 + 7 shunted with 200 mag + 400 resist
Battery put + X Receiving end
104 Conden 5 6 7 sht with 200 mag + 400 resist
105 Conden 5 6 7 not shunted.
106 Conden 5 6 7 sht with 200 mag + 1550 res.
107 " " " " " no mag + 1550 res.
108 Condensers ~~shunted~~ shunted round from 16 – 18 + also shunted with 1550 ohms.
109 Condensers shunted round 16 – 18 alone.
Sunday Morning 2 am May 2
Jd Edson
C Batchelor } 12 h 5m
E Gilliland

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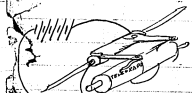
Sunday May 2nd 1875.

No 4 Solution

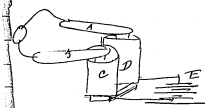
Copying experiments —
Made an instrument to copy by electricity
A round drum on which
slides 2 points No 4 paper
copied good white marks on brown
bad background can be done quick with
fine wires. Edison Batcheler Gilliland 8 AM



New. Force.

E-1676 p. 215 +15

A+B are 2 platinum plates. C D is an electro magnet. Closes by Battery E
Nothing visible on platinum
Now on brass



Ferrid paper with iron pen + brass drum make a battery track + marks, it will not do it with on platinum drum.

Tried to work from the induction of a sounder magnet 1 spool + battery + 1 + experiment.
Worked till 4 this day 3rd

Sunday Morning 3rd 9:30 AM
Edison
Batcheler
Gilliland 10h

Edison

May 31st 1875

Rotation

Found a good solution

Pyrogallic Acid

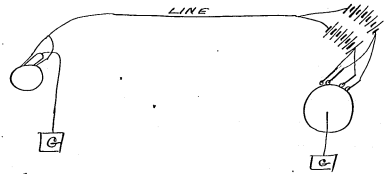
Nitric Acid in excess

Nitrate of Ammonia in excess

Yellow matt comes out reddish & marks on Oxygen.

One Wire Roman letter

Worked all night on this testing our new synchronous instrument. Ferrid paper, was able to read it almost first trial. Had considerable difficulty throughout the evening in not getting the dots on line & but getting the duplicate. found the difficulty in the perforations being wider & pens not being properly adjusted. ~~pen~~ Got tried it yet for perfect synchronism. Bad receiving pen, it must be altered.



2 Batteries 24 cells each small Bichrom. 90 ℔ Sol.
Worked all night

Edison
Batchelor
Adams
} assistants

12 hrs

May 5th 1875.

One wire Roman syncronish works very well there is a pendulum but very simple
Had difficulty with some dot dropping out which we remedied by putting a rubber ring round the receiving drum

Tartaric acid added to the Nitro gallic salt, Nit. Strong. is good making the paper whiter & making enough acid solution to prevent those dots

Sulphuric acid & Phosphoric ac make a good blotter for Nitro sol.

Worked all night
Edison
Batchelor
Gillette
} 17

May 7th 1875

A Test to Determine the transmission of positive or negative currents through a a Liquid alters the Resistance on account of direction of Current — It has been asserted in foreign publications that if a piece of platinum & a piece of alluminium placed in certain solutions that ~~the~~ the resistance is increased & diminished by the change in the direction of the current —

Water & chloride Sodium outside Alchol Inside two platinum Electrodes — No 1 — 73 — Reversed No 1 — 83 =

Water & chloride Sodium outside Benzine Inside two platinum Electrodes — No 1, 63 Reversed No 1 — 87 —

Adams, Edison
Batchelor & Gillilland

May 7th Batchelor fixed the Electromotograph with single lever by 12 midnight & then we went to work on repeating, & successfully repeated (200) two hundred words per Minute Electromotograph working with platina pen on Glycerine Solution samples not saved worked till 8 AM of the 8th of May

Edison, Batchelor, Adams, & Gillilland

May 10th 1875

Repeating by Electromotograph.

May 10th 1875

Repeating by Electromotograph.
worked all night. Had a great deal of trouble to get it going up till 1 a.m. could not tell what was trouble. It seemed ~~to gradually slip back when current was in & go forward too far when space came~~ as if the normal friction lessened after working a short time. after supper however it worked better with new paper & we kept getting it good till we reached (800) eight hundred words per minute perfect

Phenomenon,

Salt & Oil Sweet Almonds
Jump! only on opening. a friction jump.

Nit. Mercury – Salt.
Fearful friction on O; with Pyrogallic etches it & making a splendid double Arrow paper.

Na Cl, HO, & Capeped Oil
EMograph nix

Na Chl & Anise oil
Friction on O. No mark

Na Chl. & Rosemary Oil
Nix

Na Chl & Lavender Oil Nix

Na Chl. & Lemon Oil Nix.

Na Chl. & Mirbane Oil & K Bichrom.
more friction to X
Occ.

May 18 continued.

Electromotograph.

Coffee, egg, sugar + milk

Phenomenon decreased friction on Oxygen.

Pyro added to the above in good

Na Cl. & Caraway Oil Nix

Na Cl. + Cloves oil Nix

Na Cl + Origanum oil Nix

Na Cl + Peppermint Oil not very good

Na Cl + K Bichron. gives fearful thump on first closing only.

Na Cl. Caseful Oil + Proto Hg. good apparently better than Pyro.

Na Cl + Anise Oil mix

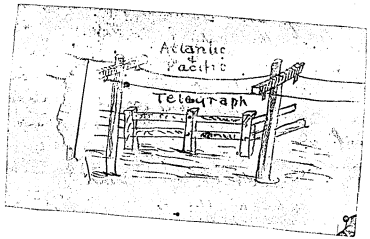
Na Cl Caseful Oil Proto Hg + Pyro mix

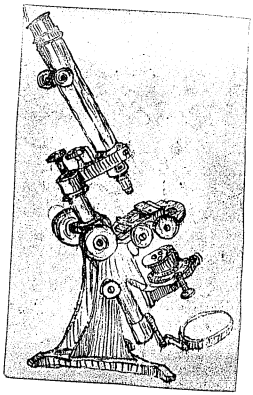
Edison, Johnson, Adams
Batchelor. 12.

New York June 1

J. C. Reiff Esq

This is a specimen of the new copying press just invented by the renowned trio Edison Batchelor & Adams





Monday May 31st

Newark N.J. June ~~X~~ 1st 1875 E-1476

The samples shown on the opposite page are the result of the first experiment tried in the new Laboratory, and for the want of a better name it will be called the Autographic Copying Press —

Tissue paper written upon by an ink composed of aniline violet and proto chloride of Iron saturated solution, the paper which receives the copy is saturated with the Ferrid Cyanide of Potassium — The ink may be the reagent for the solution in which the paper is saturated ~~and~~ produce coloration by a chemical reaction for instance, the ink may be a solution of perchloride of iron or any persalt of a metal and the paper on which the copy is to be taken may be moistened in a solution of a chemical which is a reagent for a persalt and then give a coloration

T. A. Edison
Chas Batchelor.
Jas. A. Adams
E. T. Gillilland

June ~~2d~~ 1st 1875 — No experiments tried

Error in dates altered by one "Gillilland"

Newark N J June 28

9.05 Am Experimenting, endeavoring to discover a new force — a circuit of No 17 Iron wire 25 feet in length, an electromagnet with battery is brought in contact with this wire at one end and the following contrivances are used at the opposite end to detect any manifestations

a slip of paper suspended between two points made by breaking the iron wire circuits & turning up the ends leaving the ends about one half inch apart & the paper is suspended between —

a paper saturated with Chloride of Manganese nothing that can be detected with the naked Eye — using the spectroscope gives no results —

a jet of gas is introduced between the points nothing + a candle is used — nothing —

a jet of gas is substituted for the Electro magnet = candle used for receiving — a paper saturated with salt is burned in the focus of the spectro scope. nothing —

Salt paper is burned at the sending end nothing —

Pyrogalic acid & many others are tried with same results

paper is again introduced in receiving end Electro magnet at sending end — a magnifying glass is used at the receiving end — nothing

Magnet introduced at receiving end everything else remaining the same; — paper used as an armature — nothing —

Edison Batchelor Gillland
Adams Johnson 12 Pm

all night

O was fine

E-1476

June 3rd 1875

Experiment to make a kerosene lamp John bright without chimney but without success. Tried feeding O to it but no good, need numerous entrances mixed with it but no go

12 p.m. Edison Batchelor Adams

June 4th 1875

Worked all night on celluloid made two lots of celluloid with 6 acid but did not stand test of hot alcohol. made a third lot & be tested to day with extra precautions of baking paper etc

Found a new Solvent for Cellulose (Wood naptha) hurray!! Soluble cold & I think will be cheap

Rhigolene as a solvent no good
Benzole " " " " "
Naptha " " " " "
Turpentine " " " " "
" with Resin " " " "

Batchelor Adams 12h

E-1676

June 7th 1875

Worked all night.

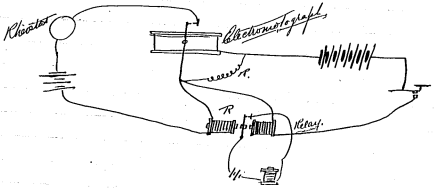
New Solvents for Celluloid:—

Alcohol & Naphtaline. cold. very good.

Turpentine & Naphtaline heat good.

Alcohol & Gum Senegal cold. not very good

Electromotograph:- Sendduplex:



Tried a preliminary experiment on sendduplex to see whether the Emg. would close quick enough as in diagram, very defective instruments. It did not work well. The principle of sending a message from each end with a send on & polarized Relay receive current with 50 cells Relay and 100 cells Emg. with 150 cells & relying on the Emg to close quick enough & neutralize the relay so fast effect & a certain extent

Ed

In working this experiment we found that when we shunted the electromotograph although there was a heavy mark by the stylus the movement of the stylus was killed.

31 for all

Edison, Batchelor, Adams.

June 8th 1875

New force all night no result.

Edison, Batchelor & Adams. 12

June 9th 1875

New force all night no result

Edison Batchelor & Adams

12

June 10, 1875.

Worked trying to dissolve sawdust soaked some in boiling caustic Potash & then tried to dissolve it also soaked some in sulphuric & nitric acids & some in HCl.

No result as yet

Batchelor & Adams

Petroleum ether caught fire while Jim had it in his hand no harm.

Edison & Johnson made statistics of A & P delay of messages

Copying press does not work satisfactory

Resolved to work daytimes & stay at home nights.

New solvent for Cellulose Nitro Benzole.

Good.

Edison Batchelor & Adams.

Now is the winter of our discontent made glorious summer
Chas Batchelor 21 ff
Now is the winter of our discontent

2nd ff
Charles Batchelor
Now is the winter of our discontent —

5th 55 copies
Charles Batchelor

No 6 No copies

Mr Edison June 11 1875

We have succeeded at last in our endeavours to take 50 copies on our press & I believe it is the first time they have been taken. It goes to prove that part of the winter of our discontent is buried in the deep bosom of the ocean

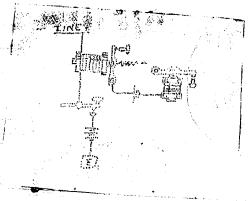
Yours in sincerest love
Chas. Batchelor

June 11th 1875

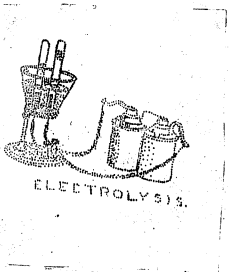
Copying experiments —

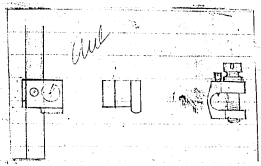
No 1 was. Solution —
~~Sol~~ — 2 fluid oz water
2 dwt Ferrocyanide of Potassium
In K Sat. sol Fe_2Cl
a little Violet aniline
a little Sugar
Pomatum grease on paper
took 21 copies
No 2. differed only in the way of laying the roller paper on.
3, 4, & 5 all took about 22 copies & differed slightly in the ink.
5 & 6. Sat Sol Fe_2Cl & Sat Sol aniline
proportion 2 Fe – 1 aniline
write with this & let dry or blot it & then coat over with Balsam for she will take 50 copies easily 55 good copies being taken with No 5 & 45 with No 6.

Batchelor & Adams
6 Wks each.



June 20th 1875





June 14th 1875

Made new arrangement for slipping on perforator rods when the key pin is broken they can be made & sent as extras & put on as the pins break.

Batchelor.

June 20th 1875

We struck the idea of making a stencil of the paper by pricking with a pin & then rubbing over with an ink.

The best ink we found to be glycerine & aniline violet. Cut a piece of steel 2 x 3 like a file but with points straight up & used it to perforate the paper by writing on it with a stylus it works but it takes such pressure to do it at all, that it is not much good, resolved to make a machine to do by clock work or engine & prick as we write, in the mean time we took numerous copies with the letter pricked by hand

Thos A Edison
Chas Batchelor
Jonas Adams
Saml Edison

12 head

1875 Experiments to find a strong constant battery

Date	Hour	Galv. 1	Galv. 2	Remarks	Date	Hour	Galv. 1	Galv. 2	Remarks	Date	Hour	Galv. 1	Galv. 2	Remarks
				200 ohms resistance on all										
Ordinary Bichromate Great battery CrO_3					Strong solution of KOH + H_2O CrO_3					Sulphuric acid / Potash SO_3 Carbon + Zinc				
June 21	9 AM	46	1		Jan 21	9 AM	34	12		~~June 21~~	~~5 PM~~	~~7~~	~~1~~	
	2 PM	62	1			2 PM	5	0		June 21	10 PM	17	1	
	4 PM	45	2	Do 1		4 PM	6	1	2					3
	~~[illegible]~~	48	2		hour	13	4	0						
23	2 PM	58	15	0			Do good.							

Lost of Iron Battery ~~outside~~ Both Poles wire kept on 25 ohms + letter on galvanometer

						1	2	3	4			
1875	Jan 23.			4 PM	72	72	93	60			Porous cup.
				5 PM	76½	76½	97	85		1	Contains NaO
				8 PM	79	78	92	84		4	Outside jar
		24		11 AM	78	78	76	56		19	Contains CrO_3 +
				2 PM	78	76	96	52		22	H_2O in porous
				6 PM	77	77	96	47		26	of 1-30.
	June	25		7 AM	46	15	81	9		41	
					15	14	16	3			

Jm

Do

1895 Chlorate of Potash & Sulphuric Acid

~~These deflections were all taken on 20 thousand ohms~~

June	Hour	Zinc Carbon	Zinc Copper	Zinc Platinum	Zinc Iron	Zinc Lead	Iron Copper	Iron Carbon	Iron Iron	Copper Carbon	Platinum Carbon	Carbon Carbon	Nitric Acid
23	3 pm	0	1 4	1 4	1 4	1 4	1 4	1 4	1 4	1 4	1 4	1 4	1 4
		52 4	46 3	42 12	[illegible]	33 1	18 1	37 1	—				
		77 57	46 33	61 40	45 17	37 29	40 17	47 21	18 20	49 20	17 1		66 16
	5 pm	47 11	64 22	33 1	48 11	62 21	19/20 5	65 15	2 1	46 12	1 0		64 11
	7 30	47 7	62 15	15 1/2	48 9	62 17	24 4	60 7	2 1	39 11	1 0		62 5
	8 30	45 1/2											
24		21 2	31 3	6 0	45 6								
	10 am												
		20 2	31 3	5 0	45 6	60 34	36 1	47 2	2 0	38 7	0 0		45 1
	2 pm	18 1	30 2	0 0	45 4	41 1	35 1	37 1	2 0	37 4	0 0		35 1
	5 pm	16 1	27 1/2		41 4	49 1/2	31 1	35 1	2 1/2	30 2			22 1/2
	8 pm	14 1	22 5		32 2	12 0	32 1	29 1		24 2			45 1/2
	5 30	13 1	22 1		19 1	13 0	24 6	27 1		23 1			43 1/2
25	9 am	28 3	41 1					43 2					50 2
	2 pm	32 1 1/2	34 1					30 1					52 2
	5 pm	32 1/2	30 1					35 1					57 2
	12 am	34 1	29 1					24 1					47 1

Batteries kept on 20 thous

on 25 thous besides the galvanometer

Bare galvanometer without extra res.

45 hrs

17

25 hrs

41 hrs

55 hrs

17

Sulphuret of Potash Tested on Bare Galv.
Repeat to 25 ohms

1845 Date	time	No. of Hrs	Zinc Carbon	Zinc Copper	Zinc Platina	Zinc Iron	Zinc Lead	Iron Copper	IRON IRON	IRON CARBON	Copper Carbon	Platina Carbon	Platina Iron			
June 23	1 pm	1	1 4	1 4	1 4	1 4	1 4	1 4	1 4	1 4	1 4	1 4	1 4			
	3 pm	2	9 0	14 3	12 0	29 4	35 19	5 2	0 0	1 2 0	12 1/2	9 0				
"	5 pm	4	21 1/2	8 1/2 2	6 1/2 0	27 2	34 5	6 1/2	0 0	1/2 0	4 0	0 0				
June 27	11 am	22	17 0	12 2	7 0	23 2	22 1 1/2	5 1/2 1	0 0	1/2 0	4 0	1 0				

Chloride of Ammonium in outside
Zinc & Carbon Electrode June 29th 1845
Battery Porous cup & rack

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	
1845 Date	time	hour	Chloride of Potash Sand Cell	Nitric Acid	Chloride of Potash Sand Cell	Sulph & Iron Protoxide	Sulphat Iron	Phosphoric Acid	Affords Ammonia	Peroxyde of Iron	Sulphate Magnesia	Sulphate Alumina		Affords Calcium	Affords Magnesia	Affords Alumina		Remarks
			1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4	1/4	
29	11	Mn	84 37	90 46	84 41													
July 1	5	Ch	26 62 16	88 71	81 10 1/2	6 1/2 1 1/2	84 19	79 1 3/2	86 17 1/2	73 7 1/2	71 7	74 20		82 37				
" 2	10	am	47 45 18	88 80	81 24	45 3	74 32	47 11	82 1/2 33	55 8	76 15	49 20		12 2		51 4	86 6	
"	5	Ch	64 45 8	88 80	80 17	36 1/2 2	57 23	39 6	70 25	42 6	65 10	39 10 1/2		91 2		124 4	78 15	
3	8	am	69 46 7	88 80	77 17	22 1	47 12	36 4	47 10	25 3	35 5	25 5		8 1 1/2		14 2	70 11	
"	4	Ch	77 42 5 1/2	88 80	60 4	16 1/2	332 7	26 5	41 8	25 3	36 5	15 4		8 1 1/2		12 2	68 7	

Edward H.

18 19 20 21

1888

Date	time	hour	Hydrochloric Acid	
July	9	9 am	72	70½
"	2	12 m 19	60	51
"	"	5 pm 24	47	46
"	9	9 am	46	36
"	"		79	74

Date	time	No hours	1 Chlorate of Pot. Powdered	2 Nitric Acid	3 Ferrid cyanide Pot. Powdered	4 Granular Sugar Pow.	5 Sulphate of Iron Powdered	6 Oxalic acid Powdered	8 Ferro-cyanide	9 Sulphate of Magnesia Powdered	12 Chloride of Calcium Powdered
			1 4	1 4	1 4	1 4	1 4	1 4	1 4	1 4	1 4
July 19	1 PM	0	74 31	88 83	82 47	65 1	71 15	82 25	69 18	71 10	67 82
" "	5 PM	4	77 31	85 84	75 18	78 15	72 19½	71 17	76 20	75 12½	69 15
" 20	8 AM	16	72 20	88 76	81 24	80 32	65 9	64 9	67 10½	74 18	29 15
" "	5 PM	25	65 15	88 80	79 10	76 3	48 7	38 7	50 5	70 10	19 8
" 21	1 PM	45	62 9	87 80	79 9	85 2	45 4	38 7	30 9	65 8	12 3

Sample 1

Now is the winter of our discon-
tent made glorious summer by
this son of york and all the
clouds that lowered upon our
house are in the deep bosom
of the ocean buried grim
visaged war has smoothed
his wrinkled front but now
instead of mounting barbed

Sample 2

Citizens Gaslight Co
Engineers Office cor 5th & Hy
Brooklyn July
s M. Fletcher Esq
Dear Sir,

eply to your favor covering e
res as to the results we obta
working the OLNEY PROCES
ave the pleasure to make the fo
statement.
These works have been mak
as under that patent for a pe
sixteen months with a result h
atisfying to the Comany and
consumers

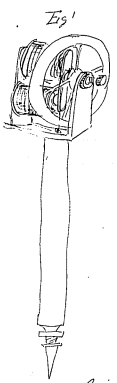
Yours Respy

Wm Henry Wh

July 20th 1875. Copying Experiments

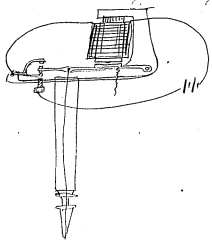
Have had a pen for pricking made to run with clockwork but found it no good so so had one made & run by electric Engine & it was finished to day. Proceeded to night & try it it worked well but ~~now~~ prick two slow

Fig 1



the cam that moved the needle was made in this way with writing slow we got along well but ~~started to work~~ making a new cam like this † which he finished & then we went to work to get the press right for working we found that if we covered the roller of press with cloth saturated with ink & rolled it over the copy it worked very good, also fastened the ~~co~~ letter round the cloth covered roller, worked well, also laying a flat piece [illegible] saturated cloth on the [illegible] the letter over it then [illegible] ing a copy on the roller running over [illegible] was got. Also in the common copying press it worked well most any way. After this we found wanted very little pressure & then a new idea dawned on us to take a painters roller with handle on it & cover it saturated cloth we also took a book & the cover out large enough & take a sheet of foolscap we then pasted our letter on the inside & then shut up the book & rolled the roller on the outside this was a perfect success & Sample 1 was struck off this way with

100 others like it.
We tried all the other aniline with Glycerine
Olive oil, molasses, some pretty fair but not as good as [illegible]
Printers ink + oil as good.
We tried to write letter on parchment but the
ink went right through it [illegible] to combine.
Started Wurth on [illegible] to be made
direct acting [illegible] getting more power like
drawing. The barrel also
to be shorter so that the
pen will be easier to handle



We propose to make our
press etc to consist of
a cabinet with iron frame
attached, + paste the
letter to the cabinet to
have a cloth top.
A rubbing roller with handle

1 Bottle (pint) of ink.
1 Funnel high twist & Porcelain coat
the last three to go inside of cabinet.
1 Cell of Grenet battery
1 Pen + [illegible]

[illegible] Beach
[illegible] Adams
Saml Edison
M Beach.

End of part

Saturday & July 25th
Sunday:- Whole Expenses for Printing Process.
"

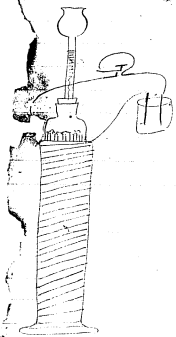
Monday 26 July 1875

Had just made an experiment to find out whether we could make a column of water rise & fall by the expansion of a magnet in it when a current passed round it

We took a glass measure & put inside a number of iron rods & then wound 3 layers of coarse cotton wire on. We then filled it up with water & pushed the cork with a glass tube fitted out down in it so that the water was half way up the tube. When we closed the key the water seemed to rise gradually in the tube from what cause we do not know as it did not recede when we opened the key. Perhaps it may be that the iron is absorbing water under the influence of electricity around it. Will try further experiment

T A Edison
Chas Batchelor

TAE



Edison

Monday Aug 2nd 1875
Made ink darker colored by
Glycerine 1 fluid oz
Aniline Red 3 grs
Aniline Violet 3 grs
Carmine 10 3 grs
Hydrochloric Acid 3 grs
small quantities of each

Edison
Batchelor
Adams
Samuel Edison

TAE
J. A.

8hrs

Wednesday Aug 4th 1875
Tried electromotograph for repeating
Noticed a peculiarity about it that it would drop dots clean out
Another thing we have noticed about it is that we sometimes work a long time before it will work & then it suddenly commences to work & it will work anyhow we fix it & we dont know ~~at present~~ how we have fixed it to make it work.

T A Edison
Jas Adams
Chas Batchelor
Samuel Edison

TAE
J. A.

12hrs

Aug 5th 1875

Electromotograph.

E-1676

We found Sesquichloride Iron
Sider
& Oil of Almonds
new good showing most on light
pressure & nearly any paper.
Had the electromotograph altered from
chain to drum & weight. When the
Electr. is in use on line it must be
turned by a crank & on the same table
a receiving instrument can be put in
by rocker so that the repeater man
can see how it is coming at any time.

T A Edison
Chas. Batchelor
Jno Adams
Samuel Edison

Aug 9th

Worked on Electromotograph all night
no particular result.

E. B. & A.

Aug 10th

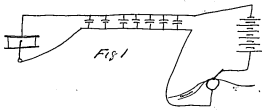
Electromotograph all night
Got it working on short circuit & repeating
600 words per minute with 10,000 ohms in
transmitting circuit. by adjusting lever of
Electromotograph very close it requires much
less spring & wanted very slight spring
so you could run any speed from 10 to 300
words without altering adjustment.
Called up Cogger of a & P & had him transmit
through a line composed of a wire to Philadelphia
& back & then to Newark by old Atl. wire about
(230) two hundred & thirty miles. and 5 cables
We found now that although we got it perfect on the electro-
motograph paper we could get nothing
intelligible on the repeated circuit. This was
very strange as we had been able to get
it on a 5000 ohm circuit in the laboratory
when we made marks on the paper of the electromotograph.
Now the difference between the 2 lines the artificial
& real was this; the artifical line had no
sending shunt or receiving shunt & no static
discharge, whilst our outside line had
a magnetic sending shunt & the static
discharge from about 230 miles of wire & cables.
the artificial was thus instantly opened
after each closure having no route for any-
thing such as static induction or whatever
else may be the cause to pass. Whilst the
outside line was never opened owing to the
sending shunt at Red Bank being in.
~~It was between 2 causes. Static induce or~~
~~the magnet in the sending shunt.~~ We now
put in a magnet shunt on our resistance trans-
mitting circuit & we could not get anything
although we got the marks on Electromotograph
very good; we now put in a plain resistance shunt
& we still could get nothing. We now came
to the conclusion that there was a secondary

action from the Autograph something like the secondary action from a magnet & as long as the line was shunted it there was an escape on it which is the same thing it gave a route for this secondary action to court & mutilate the signals. We shall now proceed & find out the nature of this secondary action.

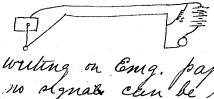
Thos A Edison
Chas Batchelor
Jas Adams
Samuel Edison

Aug 11, 12, 13, & 14th 1875

Electromotograph as a repeater.



1. With no condenser can get about 600 or 800 words per minute even in 10000 ohms and 25 cells carbon battery. 2. When shunt is added as in fig 2 with 200 ohms resistance we can get nothing although just as much current passes through the paper & the writing on Emg. paper itself is just as perfect no signals can be repeated at more than 25 or 50 words per minute. 3. Putting a 200 ohm magnet in the Shunt besides the 200 plain gives no better result. 4. Putting in but 1 cell of the magnet does no better.



5 Adjusting the cores from + to the armature no better. 6 Putting magnet in main line at transmitting end without Shunt no better.
6 Taking out magnet, keeping in shunt & adding 10000 ohms in line at receiving station. no better.

7 Adding magnet in main line with & without 10000 ohms no better.
8 Putting in a 5000 German silver magnet no result
9 Putting in 2 " " " " "
10 Shunting Emg with magnet no result
11 " " 2 " " "
12 Shunting Emg with plain resistance & adding magnet in branch containing Emg. a little better result.
13 Shunting Emg. with another Emg. in motion increases speed greatly but owing to the variation in the pressure which I held the Emg point & threw the other Emg out of adjustment constantly
14 By using a secondary battery of Platina & Platina immersed in Iyo sol. we got very fair speed but when we shunted Emg with a large condenser 8x6 the speed was the highest we have ever got from 1000 & 1100 words per minute perfect
15 When condenser was taken off could get nothing
16 By taking shunt off at transmitting end could get 600 or 700, the resistance, the resistance of line was 1000 ohms; the shorter the circuit the greater the effect of a closed circuit in which the secondary current or other disturbing force from the Emg. We are not sure as to what kind of a force circulates from the Emg after the battery is disconnected. The condenser seems to completely neutralize this secondary effect if there is any. The effect might perhaps be due to another cause to wit—

We have always noticed that on Hydrogen solutions when there is no static charge or lateral induction the first portion of a dot or dash is the strongest thus:—

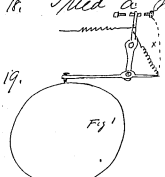
-- — — —

We have also noticed that the power of the Emg when worked by hand appears to be strongest on the first closing of the current & in working we have noticed that with certain adjustments when the circuit is first closed the lever moves with great power in a direction contrary to the revolution of the drum but immediately flies away from the contact point in the same manner as if the current had been so weakened that it had not enough power to hold it there though in this case the current was of constant strength. This phenomenon prevents an equal adjustment & as we have previously noticed most solutions through a resistance will 'tail' even in laboratory the addition of a shunt will in most cases stop tailing & make sharp writing hence the addition of a shunt only aggravated in this ~~the~~ case the phenomenon making writing perhaps thus - - - - - -

Throwing the Emg more out of adjustment the effect from a condenser would be to counteract this thus the first part of the current coming over the line would pass through the Emg & Condenser the portion which rushed into the Condenser to charge it would be withdrawn from that portion which would pass through Emg were there no condenser, hence the first portion is weakened but the condenser almost instantly becomes charged & the last portion of the current passing through Emg hence instead of dash being thus — it is — or perhaps even as regards the Emg phenomenon but in reality too as recorded thus — first part being weak & as the first portion of the current acts strongest on Emg. the lever comes forward with a certain force just as it would tend to weaken

& fly back as before mentioned the condenser is nearly charged & the current increases in strength counteract & prevent it. the discharge of a current of opposite polarity through Emg from condenser after battery is disconnected does not appear to effect it at all so may under these conditions be an advantage.

18. Tried a new lever on Emg thus:-

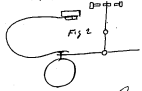


19. It could not be made to give a single movement with spring as x neither could it by putting it as shewn in dotted lines after almost giving it up as a failure found that by holding my finger on the platina friction points that at times when working a key I would get a very strong movement after further experiment we found that if I held my finger on so as not to cant the lever from or towards me & thereby prevent friction in the fulcrum I could get the movement. We therefore concluded that slight frictions in the moveable lever of the Emg was of far greater importance than I had heretofore supposed. I then had levers taken out & shoulder screw eased up & burnished so as to diminish the friction as much as possible although far too great after it was done

20

21

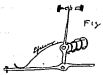
22 then tried it & so putting on spring as in fig 2



we succeeded in repeating without shunt about 600 words per minute this shows that at high speeds & with tailing etc there is great difference in the frictions although the lever responds so noticeably & conveys the idea of a great difference & that it takes but slight friction in the fulcrum of the moveable lever to neutralize completely the

23 little difference we also tried putting spring as in

fig 3 it did not work but it was before had bearing were eased it write perhaps work with frictionless bearings



24. Best Emg solution ever saw on H.
Lactate Zinc
Salt
Caustic K
Peroxylitte spirit
Note Caustic Potash is better than Sol alone & together.

25 Silicate of Soda
Salt
Note. Oxygen splendid slip almost as good as reg. on H. On H it is very slight though plenty to work Emg. the trouble will be that the Sil Soda dries to crust & it becomes insensible in a few minutes. Peculiarity on H is that paper is quite slippery without current hence pen is not clutched by normal friction so fiercely when current is off as in ordinary sol.

26 Nitrate Lead
Caustic Potash
As for Emg on H Slight slip on O.

27 Salt added to above but no better

28 Coffee
Salt
Sulphate of Quinine
No good
Added Caustic Potash & decreases friction on both sides Excess of Caustic K makes slip on O almost as good as reg on H but H is reduced.

29 Fuchs
Salt
Good as regular on H & cheaper

30. Borax
Salt
Muddling good on H & slips very slightly on O. Caustic K added no better on O, good deal better on H Bi Sulphate of K added makes slip on O better than any above

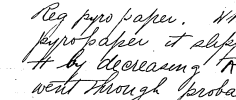
31 Glycerine Water & Sugar,-
Friction on H & O, O strongest
Added alitter KI On Zn & Pt only
O's friction increased very much, on both sides about equal used flat flat plate
Salt added, slight slip on H but increased friction with O on all metals.

32 Boss solution
Coffee, milk, sugar, & eggs, Caustic K & salt, equally good on both sides perhaps a little better on H but by proper proportions can probably make them equal

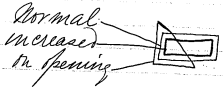
T. A. Edison
Chas Batchelor
James Adams
Samuel Edison

Monday Aug 16 1875.

1 Discovery of a new Phenomenon on the Metals on Hand Emg.
Aluminium Nickel Zinc Sn platina Brass Silver Lead.
2 cells Carbon battery new. Key + Rheostat thus



Reg pyro paper. When all current passed through pyro paper it slipped on all metals with it by decreasing R so that a small portion went though probably + all the metals except tin showed an increase in friction on passing the current but tin better showed the slip, but by still further shunting the current so that but little passed though, tin stopped slipping + increased its friction. Another noticeable thing was that when all metals except tin had an increased friction on the moment of closing the normal friction was increased say 10 degrees on opening the friction was increased 20 degrees but almost instantly subsiding as soon as the current was interrupted the friction was frightful strong.
The friction may be represented thus:—
Normal friction ——
Increased " ——
Friction on opening —
or.

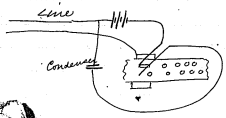


2 I then tried paper wet in a solution of Caustic Potash but on account of small current used it did not show anything being nearly as sensitive as ord. pyro.
3 I then put some salt (NaCl) in with the Caustic Potash when I found that this strip far excelled in delicacy the Pyro and gave an unexpected phenomenon
No increase of friction could be noticed on closing but all metals after the current was very much weakened gave no results except Zinc + this was very marked after all others even tin had ceased + the slip was noticeable.
This paper was the most valuable yet found + should be used on a Zinc drum

4 I have found that silver is even better than zinc on a very low current though on an exceedingly fine current zinc may be better. Aluminium appears well on a fine current + is all slip with strong momentary opening friction.
5 Dull wood paper + it appeared better than common fibulous perhaps thick wood paper would be better
6 I give Zinc the preference over silver on a low current on thick wood paper
7 Platina is exceedingly bad gives very little with full current but on Zinc muddling
8 Silver slips on both + + O but O very slightly perhaps some others do but not noticeably
9 We wet 2 rolls of Caustic K + NaCl + used on Emg. found that with sending shunt 1500 ohm + the condenser that we could by shunting Emg. repeat slowly so that it could be heard though

very ragged, without shunt nothing

10 With the arrangement in fig 3. words could be read but they were some what ragged there is something in it this weakens the first part of a dash & leaves the end the full strength, as the first portion of battery current has two routes the line & condenser & until condenser is chg full current dont go on line the second roller pen short circuits the condenser through the discharging holes & prevents its charge going on the line with the potash & pall paper highest speed straight 1500 ohms & 25 cells battery that was ever obtained about 1200 words per minute.



11 With the new lever we could get high speeds but the repeating contact was very inferior for some reason we had no spring on platina point yet. I am under the impression that the old straight lever vibrator would do good repeating without a spring; we intend putting on spring on new lever to test contact.

12 The lever used with the potash salt paper was the old style. After getting 1200 words per minute straight (ie) 500 ohms I shunted Emg. with 100 & also 1000 ohms but could get nothing readable at 45 words per minute this shows that some powerful secondary force action or otherwise circulates within the closed circuit which throws whole thing out of ~~circuit~~ adjustment.

13 We have found that the thin wood paper used for perforating answers admirably for Emg it is more even & less friction than rag paper used for receiving but ruffles up with pressure & requires dampening after wet overnight with Nacl & KCO

We now 5.30 am are going to make various Emg solutions for test on Emg (hand) to endeavour & obtain a paper free from this secondary phenomenon

14 Sulphate of Copper increases friction on H very powerfull when not shunted when not shunted on O it increases friction when shunted it slips best on Zinc

15 Bichromate Potash on H feel slips slightly, on O feel friction great vibrating, shunted, friction best on silver shunted lower still friction good on silver

16 Sulphuret of Potash nothing on any except slight thump on silver on H

17 Tartaric Acid nothing

18 Grape sugar friction great on O platina & Silver best

19 Borax friction increased on O platina & Silver, nothing on H

20 Cream of Tartar nothing on either

21 Carbonate nothing (insoluble)

22 Hyposulphite of Soda nothing on O slips on H good best on platina & silver latter perhaps better, even shunted does same

I have 2 cells 45 ohms in main line & Hand Emg. shunted with or without 20 ohms

23.- Hyposulphite Soda & Sesquichloride Iron checked nothing on O. Friction increased on H but nothing noticeable when shunted

24 Hyposulphite Soda } makes black mark
Sesquichloride Iron } on platina with
HCl platina might be
built up for a platina solution.
Tartaric acid dont improve mark
Grape sugar " " "

25 Sulphate Zinc slight slip on O
Friction considerable on H

26 Uric acid very slightly increased friction in O

27 Ordinary pyro acid one way & then another valide 2 minutes from same pole I think phenomenon must be in Platina absorbing gas.

Thos A Edison
Chas. Batchelor
James Adams.
Samuel Edison

Aug 14th 1845

Electromotograph

1 Sulphate of Zinc: apparently insoluble nothing,

2 By sending reversals H increases friction greatly apparently normal friction on O, shows slightly shunted 2 cells carbon through 20 ohms gives black mark with platina on H work it up.
added nitrate of ammonia, mark immediately fades, but slips very slightly on O, nothing on H, increases on O when on silver

3 added Caustic Potash no mark
Slips little better on O dont increase on H added salt nothing.

4 ~~Chlorate~~ Nitrate of Manganese decrease slightly on H
Nitrate ammonia added nothing
Salt added nothing

5 Oxalate Strontia nothing
apparently insoluble

6 Chlorate Potash nothing
added Hypo sulphate Soda nothing

Increased battery here from 2 to 5 cells

7 Tungstate of Soda increase very slightly on H decrease on O

8 Tungstate of Soda & Salt slips slight on H also shunted increase slightly on O.

9 Nitrate Magnesia slips slightly on H no extra friction on opening nothing at all on O, addition of Caustic Potash nothing extraordinary

10 Nitrate of Lime slips fair on H
gives mark on H when over silver that
develops in course of 20 H. 20 seconds
very red.
Addition of Nitrate of Silver apparently
marks on both sides best on H will
mark without current but soon wears off
very Tailey (Phenomenon)
Nitrate of Ammonia added to Nitrate of lime
+ nitrate of zinc makes very black closing
polarizes fearful (Phenomenon)

11 Hyposulphite Soda no better but not so
much polarization tailing marks
Caustic Potash added mark sharp + good
fair platina Solution
Nitro added makes marks worse
For Cmg no good.

12 Glacial Phosphoric acid slight slip on H
Caustic Potash added mix

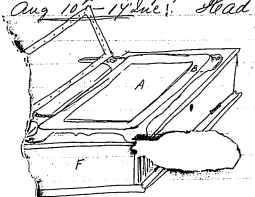
Thos A Edison
Chas Batchelor
Jas. Adams

Aug 14-1875

Aug 14 1875

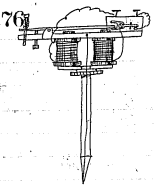
Copying Experiments

Aug 10th-14th Inc.: Had press made like this



F is a cabinet
B is an iron frame cast
C is a frame with needles
in it put the copy down
hinged at E + D is the
support for C when you
are putting in the letter.
The difficulty we found was
that the pins would stick through the copies
pick them up, so we wanted something
that would hold the letter + not interfere
with the copies. We altered the frame C
the + put 4 clips in the corners like this

but we wasted no time on
this as it was a
palpable failure we
then had it altered to just 3 little points
in the corner but this would not do then
Batchelor put springs on like this, flat spring
with points. it worked first
rate when you put the paper
in you raise the springs
with the adjusting screw
put the paper under + press
[illegible] be im-



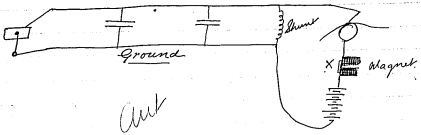
Ordered Gilliland & Co to make a pen like this with coarse wire. Altered Engine pen to double armature spots but no good.

Tried taking copies from pad wet pad with ink & lay letter on it now lay a sheet on & roll it with a plain dry & but not so handy as the other

We find we can the Photographs with the process we took a photograph & pricked all over but not so deep as to go through to raise the surface we then smear with ink & put off again there will be enough ink in the holes to make a splendid copy by pressure

Tried soaking paper in resin dissolved in alcohol but no good for writing on.

We find the foolscap we have here is not so good as the large letter because it is thinner & more liable to blot the [illegible]



Ink

The object of inserting the magnet in the circuit between the battery & the instrument was to weaken the first part of every signal sent having the last part full strength & cut off sharp for instance on closing the circuit passing through the magnet meets the self induction current from it & is weakened but quickly gets full strength as induction current dies away, on opening the extra current from the magnet has no place to circulate it being broken entirely by the perforated paper cannot go on the line & producing the mark the record should be thus :-

— ---- — —

As has been previously mentioned the Eng record where there is no static is thus well a straight current.—

— ---- — —

I thought that the above would compensate & make it even, for some reason could do nothing probably because we had to use a shunt & the secondary charge from the Eng threw it out of adjustment as above described.

I find that it wont do to have too light a pressure on the lever of Eng, the delicacy is apparently increased by pressure

T. A. Edison
Chas. Batchelor
Jas. Adams
Samuel Edison

Aug 22nd 1875 Batteries.

In experimenting with mucillaginous substances in the porous cells of batteries to prevent polarization we have found that they do in a great measure prevent it.

Thus Silicate of Soda & Caustic Potash in a carbon zinc battery shews a deflection on high resistance Coil No 1 of Bradley galvanometer of 55 degrees after 24 hours 50, after 65 hours 46 degrees.

With mucilage & chloride of Ammonia at first 30 degrees then in a few minutes it appeared to polarize & run down to 24 at which it stands after 63 hours Glue & Caustic Potash very change by all again:—

Thos. A. Edison
Chas. Batchelor
Jas. Adams

Aug 23rd 1875. Monday.

Battery Experiments.

W. F.

Clean cell – Carbon & Zinc
2 part water 1 part Glycerine in porous cup a few pinches Chl Ammonium in outside & in porous cell
Bradley Galvanometer & left short circuited

	1	2	3	4	
12:10 PM	30	18	5	4	Aug 23
2:31 PM	22	12	3	0	
2:00 PM	14	8	2	½	Aug 24

No 2. British Gum & Chl Amm in porous cup & Chl Amm outside

	1	2	3	4		
Aug 23.	33	29	21	3	2	24 PM
24	15	11	5	1	2	PM

No 3. British Gum & Caustic K

	1	2	3	4		
1875						
Aug 23	37	35	33	5	2	24 PM
24	13	10	5	½	2	PM

No 4 Silicate Soda & little H O in porous cup H O outside & Sol of Cyanide K out Fin

	1	2	3	4		
Aug 23	48	45	52	9	2	46 PM
24	16	10	3	½	2	PM

No 5 Gum Olibanum + Water porous cell
Chl Amm in + out Short circuit

1875	1	2	3	4	
Aug 23	61	60	79	29	3 40 PM
24	8	8	10	3	2 PM

No 6 Mucilage + Caustic K

	1	2	3	4	
Aug 24	16	13	7	1	2 PM

Aug 23rd 1875
Electromotograph Experiments

1 Made line equal to (Buffalo wire) that is only just to be got at 150 words per minute + poor at that
We got 50 per min through Eng with paper dipped in solution of
Water 10
Caustic K 1. Standard Sol
Silicate Soda 2

0 What we want to find now is a solution to wet the paper with that will do better than this

2 Coffee, sugar, milk, + eggs, nothing
3 Silicate Soda + Chl Ammonia solidifies
4 Dextrine + Caustic K mix
5 Kerosene Glycerene + Caustic K mix
6. Boracic Acid Tannic Acid + Caustic K with no shunt on at Eng can get about 10 per minute comes all mixed up + not very reliable
7 Gum Kino + Caustic K
About 10 words per minute full of dots perforce no shunt on Eng.
8 Citrate Lime + Mucilage + a few drops of Silicate Soda no good

9 Cyanide K only mix
10 Gum myrh + Caustic K mix
11 Annatto + Caustic K mix
12 Chl. Amm + Gum Arabic mix
13 Sulphate Lode this nothing at well
Blot tered paper.
14 Grape Sugar + Caustic K mix
15 Sulphate Magnesia mix
16 Gum Olibanum Caustic K mix

17 Logwood & Caustic K
about 20 words good for further experiment
18 Fustic & Caustic K no good
19 Common Lard oil no good
20 Logwood, Caustic K & Salt no
21 Logwood, Caustic K, Pyrogallic acid } good for 20 words.
22 Nitrate of Ammonia nil
23 Valeriate of Zinc not good try again
24 Protochloride Sn no good though I think it may be with something
25 Soap, Caustic K } 20 words without shunt try again
26 Acetate of Strontia nil
27 Citrate of Potash got about 40 words per minute at one time there is something in it

Thomas A Edison
Chas. Batchelor
James Adams
E. H. Johnson

1875

1 Aug 24 When certain chemicals are placed in a solution of Silicate of Soda water there shoots up from the crystals beautiful forests or trees in some instances reaching to the top.

2 Chloride of Iridium gives very thick trunks like trees while nitrate of cobalt gives thin long grass.

3 Sulphate Manganese shews growing from the crystal very fine thick white glass the Chl Iridium is like cactus & grows large

We find that after tree is formed, if destroyed it dont grow again in the

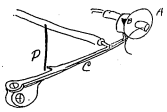
air bubbles carrie the chemicals up & Silicate of Soda being thick goes slow & every part of the chemical that is carried up is precipitated forming hollow trunks or grasses

Electromotograph

We have found that when pyro paper is used on any of the metals (platina included) that by drawing the platina stylus connected to the Zinc of the battery over the paper a great number of times that there is deposited an insulating substance on the metals underneath & on a very short time no marks can be obtained except the paper is very wet or the paper only damp but with great pleasure Sin acts worse than platina

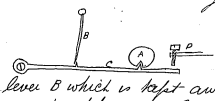
Thos. A. Edison
Batchelor
E. H. Johnson
Samuel Edison
Jas. Adams

Aug 23rd 1875
Next stop movement for Domestic Recorder Had the stop altered whereas before it was stopped by the lever being brought sideways to stop the vibrating pin as in fig 1 A is a shaft of recorder carrying a collar on which is a small cam of glue B which when it comes round



to pin on end of lever C pushes it over so as to engage D the vibrating pin, however sharp the point is made on lever it will sometimes strike right on point & instead of going on one side of pin it strikes & bends it at each

times when the circuit is opened it fails & release & consequently the recorder does not start soon enough in order & obviate this we have arranged it in this manner Fig 2



When magnet is closed the screw D has thrown lever C out of r & consequently away from lever B which is kept away by a turning round & r rubbing on periphery By this arrangement that strain is done away with which occurs when the two strike on their extreme edges, in this case if they do it does not matter as the screw D knocks it out of the way entirely & does not depend on a spring

Thos. A Edison
Chas Batchelor
E. H. Johnson
Samuel Edison
Jas. Adams

Aug 24th 1875

Electromotograph Experiments Repeating.

We tried 19 different solutions for repeating on Emg & then put on the regular standard Silicate of Soda solution as we could get nothing we found the regular would not work up to 75 but gave dash letters only found that the dot roller in transmitter was all dirty & immediately cleaned it & tried reg (page 283) keeping the wire under same conditions of Suffolk wire page 283:-

Not
Acetate of Mercury }
Silicate of Soda }
Splendid Can get shape of words at 500 words per minute get it good at 150 words by shunting it very low 40 ohm

magnet r. 30 plain gold good at 200 — 300 words per minute It is hard & break up into dots at high speeds, but it has the feature that no extra motions are made & that it repeats just as current comes over line thus ---- First dot weak repeats weak We believe that this solution will give all that is desired & will repeat signals into a second circuit so they can be recorded direct on Ferrid paper

The words are unbroken at 500 words per minute

Lycopodium
Silicate of Soda
Not much good say 25 words a minute it throws in extra dots at 40 words.

Acetate of Lime no good

Chloride of Uranium no good

Citrate of Potash (white) not very good (extra dots)

Potassic acetate of Uranium not much good.

Bichloride of Mercury can read it at 125 words geeces it at 150 (extra) something in it I think

Oxalate of Cerium not much good cant shunt it low.

Hydrobromate of Ammonia nice

Nitrate of Zinc — mix

Nitrate of Magnesia — mix

Sulpho Carbolate Soda — mix

Carbazotic Acid — mix

Sulphate Morphia — mix

Sulphate of Manganese — mix

Phosphate Soda — mix

Muriate of Bisemine — mix

Caustic Magnesia — mix

Acetate Mercury alone — very good

Acetate Mercury } this combination makes
Silicate Soda } all that is desired

Thos A Edison

Chas Batchelor
E H Johnson
Jas. Adams.

Aug 25 1878
Electromotograph Repeating

Acetate of Mercury & Caustic Potash is best yet

Acetate of Mercury is good if you have a large amount as it does not dissolve well.

Nitrate of Mercury is good but you must use it without shunt but not very sensitive.

Acetate of Mercury } nothing
Nitrate of NH_4 }

With Acetate of Mercury } No 1
& Caustic Potash }
Sample was repeated at 23½ words per minute shunted with relay ½ ohm not readable direct & besides the current is so weak when shunted you dont get any current showing the extreme delicacy of Chg.

Acetate of Lead } very sensitive but
Caustic Potash } closes in the spaces.

Thos A Edison
Chas Batchelor
E H Johnson
Jas. Adams

Aug 26 1875

Batchelors stock Printer

An alteration in this instrument was the formation of the letter by the aid of 4 pens in order to make the figure 8 plainer it works well & this was taken to day. The pens work better rigid instead of having up & down play.

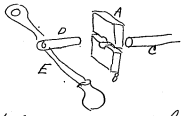
Chas B Batchelor.
Thos A Edison
E H Johnson

Aug 26 1875

Gaspipe threading

A few methods of putting threads on gas pipes & inside.

1st Heat the end & put on by pressure in the following manner



The two half dies A & B are worked by pressure just in pipe C under the dies A & B then pull ram D in the tube & put on thread by pressure on A & B

2 In drawing leave it bell mouthed & press it down

3 Find some way of eating it out with acid.

4 Make the end smaller than tube & drive plug in & force up into a die.

5 Use an iron disc running rapidly & make pipe feed the pitch of thread & also turn forward

Thos A Edison
Chas Batchelor
E H Johnson
Jas. Adams.

3 lbs. 7 oz
36 mice
Gelelands

Newark Shop Notebook, Cat. 1181

This set of forty-six unbound and numbered pages covers the period August 1871-January 1872. The entries, dated and signed by Edison, are in his hand and contain descriptions of the components of printing chemical telegraphs and perforators, supplemented by detailed ink drawings. The names of Samuel Edison and Joseph Murray appear as witnesses.

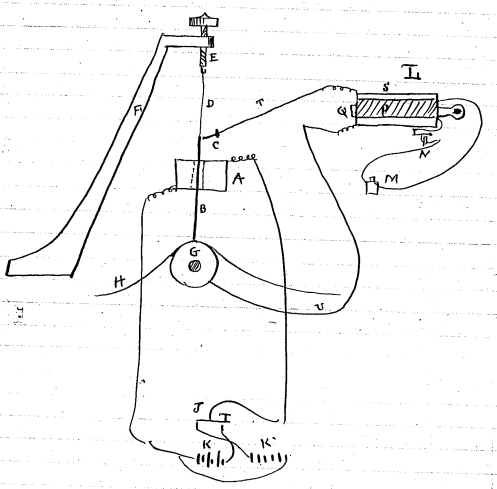
Blank pages not filmed: 18-31.

Newark N.J. Aug 5. 1871

Record of ideas conceived, and experiments tried on miscellaneous Machines and things, to which dates are appended, and such record to be used in any contest ~~regarding~~ or disputes regarding priority of ideas or invention,

T.A. Edison

Device for recording upon ~~chemical~~ upon chemically prepared paper by a "jump spark" or Current of electricity of high tension. Fig' 1 will give the principle of the device



This device I do not consider fast ~~enough~~ and not applicable to Automatic or fast Telegraphy, but that shown in another figure 2, is. —— The main result which I have endeavored to obtain in this device is producing or effecting a visible record by ~~an~~ use a very feeble Current. Sir Wm Thompson some time since invented what is known as the Syphon Ink Recording Galvanometer, which is used on the Atlantic Cable and is the first recording Apparatus which had no friction in its parts. In my device I am enabled to move the recording parts which much less Current than the Apparatus of Sir

Wm Thompson and also dispense with a large amount of apparatus which accompanies that apparatus.

In my recorder the pen B consists of an exceedingly fine steel needle of about 1½ inches in length and suspended within a helix A of very fine insulated wire, and held by a single fibre of silk to the adjusting screw E. the drawn end of the suspended needle B after passing through the helix A nearly touches the paper, chemically prepared, upon the drum G which is rotated by suitable Machinery. The helix A is connected to the line and battery K and Break Key J so that by opening & closing the Key alternate positive & negative Currents will be sent of the line and the needle B deflected back and forth over the paper but not touching it. With the exception of having the chemically prepared paper under the end of the needle, so far it is but a Common galvanometer,

C is a point adjusted quite closely to the needle B but not touching it. This point C is connected to the Secondary Coil of a powerful "Inductorium" by the wire T and the Drum G to the other end by the wire U so that when the Vibrator N and primary Coil is working powerful Currents of electricity will be generated of sufficient tension to jump from the point C to the needle B. thence jump through the wet paper to the drum & back to the Inductorium forming a complete circuit. this current in passing through the chemically prepared paper decomposes the substance with which it is saturated and leaving a mark of the paper is carried along Continuously by the drum G. And the needle B is at rest a Continuous ~~mark~~ mark will be left on the paper, the positive & negative Current passing with such inconceivable rapidity through the paper that the line is continuous. If now the needle is moved back and forth by equally the Key J a Zig Zag line will be given to the right by a positive and forming a dot and to the left by a negative and forming a dash — Fig 2

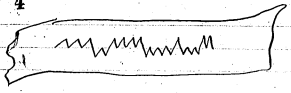
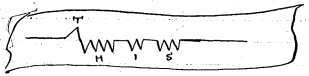


Fig 2

The word "this" would be recorded



Above drawn & written Aug 5 1871

Witness. Samuel Edison T A. Edison

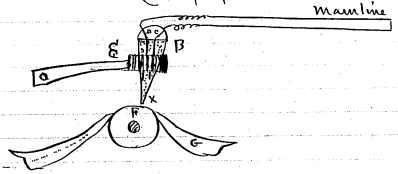
I will mention here that the inductorum can be dispensed with and a magneto electric machine used to generate the high tension current, I do not wish to confine myself to any particular device for making the high tension current, I make a zig zag motion right to left & left to right and recording the jump spark upon Chemically prepared paper as it can be done in innumerable ways many of which I could mention but which I consider quite unnecessary. What I will probably claim when I apply for a patent will be the General feature or principle underlying the Combination to produce the effect.

I will now explain a modification of this device for recording very rapid writing. In this Case – No I will not – I was mistaken –

An Idea strikes me that sulphuretted hydrogen or some other gas that will discolor certain chemical solutions Could be used in Chemical Telegraphs. Supposing a long strip of paper was prepared with a chemical Solution Which would be discolored by a certain gas, and a fine jet of this gas was let play upon the surface of the paper and the paper carried forward by clock work a Continuous mark or line would be made on the paper if the jet was controlled so that it could be

let off an on by an electro magnet placed in the main circuit, it would produce the same results, as the decomposition of the chemical solution by the electricity itself, and an advantage gained would be that the marks would not tail out and that the mark could be made large or small without regard to the strength of the current which worked the magnet.

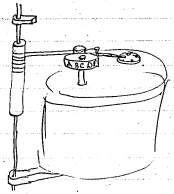
Ink recording Telegraph



F a paper carrying drum over it suspened and held by E is a air tight bulb B filled with ink into which is connected the main line wire D and C. at every closure of the current, gas is generated by the current passing through the ink and decomposing the Water contained in it, this gas expands & pushes the ink out at the End of the bulb B at X through a very fine aperture, and it falls on the paper, so that as long as the Current is closed gas is made which continues to force the ink out through the aperture X on the paper which passing along leaves a continuous Mark of the Current be now interrupted no More gas is generated and the ink ceases to come out of the aperture X —

8th August. T A Edison

Witness Jos T. Murray

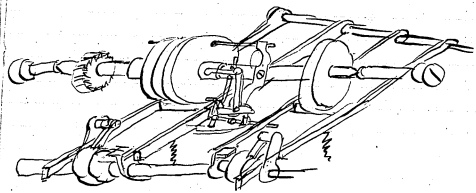


Dec 24 1871

Sliding pasted reel for pasting strips of a printing Telegraph machine on a mss form.

To prevent the saws composing a gang saw from running out of fine file or cut small teeth on the side of the main cutting teeth, so that when the saw runs out the strain will make the side teeth cut & work itself back to its normal position

Dec 24 1871



Device for printing on two strips on the Universal Stock Printer, the usual type wheel shaft being provided with an extra ~~[illegible]~~ Type wheel & an independent Printing Lever beneath it, and paper driver. So when you want to stop Printing on the main strip you rotate the Type wheel around to the letter Z where there is a pin ~~[illegible]~~. When the printing lever is brought up this pin strikes a slide bar and shoves it underneath the extra ptg lever and locks the two levers together, so that by working the main ptg lever the other one goes with it & prints characters from the extra wheel but the pad on the extra ptg lever being much higher than on the main lever it does not allow main lever to touch type wheel consequently it does not print. Now when you desire to stop ptg on the extra lever & type W. you turn around to the main dot and strike the ptg lever and a pin from the shaft of the type wheel throws the slide back from underneath the extra ptg lever consequently it ceases to print

I do not wish to confine myself to any particular way of doing this, but claim printing upon two strips of paper by Double Pty Levers & their selection controlled by the position of the type wheel in conjunction with the power derived and the upward or downward motion of either Printing Lever

Dec 24 71

I claim in a Printing Telegraph for type wheel bands of Rubber type, not hard rubber but pliable rubber type in bands and attached over a flat disk,

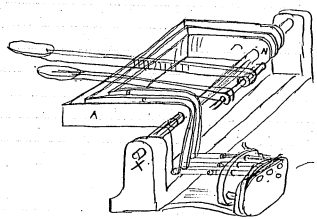
Dec 24 71

I claim fitting a band of ~~st~~ silk or other fabric closely over the Type wheels of a Printing Telegraph & allowing the ink roller to link thereto, instead of the type direct, the object of which is to prevent clogging up the type wheel with fuz from the type wheel

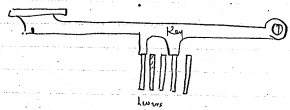
Dec 24 1871

Jos. J. Murray

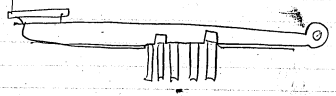
Perforator for Telegraphs



a B C are levers I use nine of them they are worked loose on the shaft X which is its fulcrum These levers are made of 1/8 inch sheet steel and very broad so as to give them the required strength, one is placed inside of the other, & the whole are placed immediately under a bank of keys, In practice I obtain the selection of any ~~key~~ key by making tits or teeth on the key thus

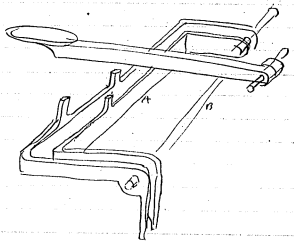


Or these teeth knobs or projections on the keys may be thus

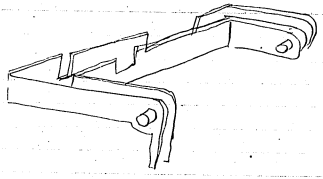


or they may be dispensed with altogether on the Keys and the teeth made on the bars or levers or notches may be Cut in the levers thus

Fig 3

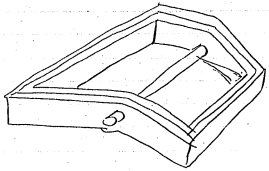


or this way

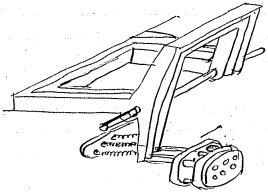


Some trouble may be anticipated by the springing of the levers but this Can be obviated by Connecting a strengthening lever as in Fig 3 from A to B

Or the levers Can be made in this manner



Each square swinging seperately or it Can be made in this form

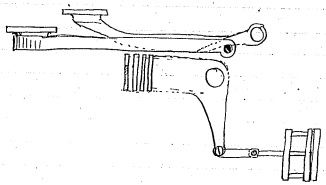


The form of lever is probably better than the ones heretofore discussed owing to the strength of the levers

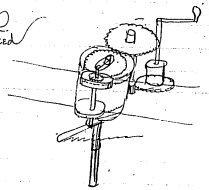
The paper feed device which I intend to use in this machine is peculiar the motive power being derived from a spring or weight, or any outside power not derived from the pressure on the keys.

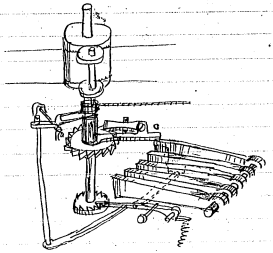
The length of the paper fed is controlled by the levers or by the keys.

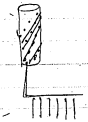
End view



Paper Feed





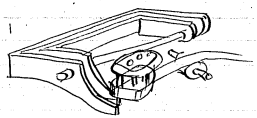


about perforator Jany 13 1872

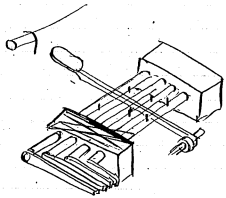
Witnessed Samuel Edison T A Edison Jnr

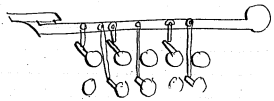
Perforator = I do not wish to confine myself to a die and punches, for I believe they could be dispensed with and cutting punches hollowed out, and cutting on a hard raw hide surface, be substituted with advantage, ~~when~~

Should my paper device prove to be badly arranged in an upright position, the die may be set flat ways instead of edgeways as heretofore shown. Thus (

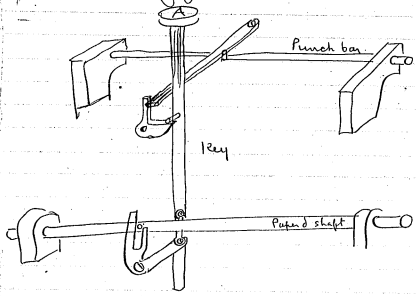


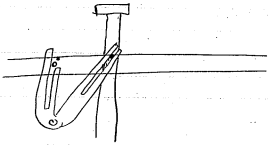
The flat-bars may be deepened with the several round bars substituted. Thus

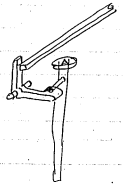




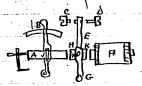
New movement for perforator







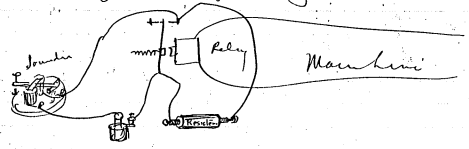
Relay



A is a permanent magnet acts on piece iron H on armature F F is line magnet K its armature Lever E pivoted at G plays between line points C D. B is handle for adjusting permanent magnet closer to its armature,

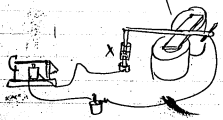
The object of this invention is to dispense with a spring weight gravity etc and adjust with a piece of magnetic steel,

I get around the gauge patent in this way not opening the circuit



When the lever flies back the circuit is only lengthened (10) its resistance increased

Another way



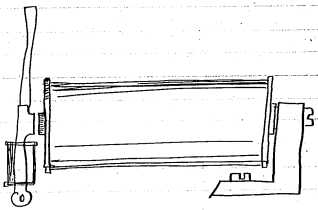
X is a tube, the points being in water when the points are seperated the circuit only passes through the water but is not broken.

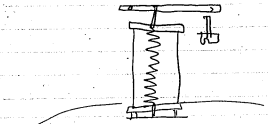
I claim increasing & decreasing the resistance of a local circuit by the action of the relay of another circuit, or mechanically

increasing & decreasing the resistance of any circuit by resistance thrown in or out by a break or Contact points to produce effect at a distance in local or other circuit

Feby 1 1872

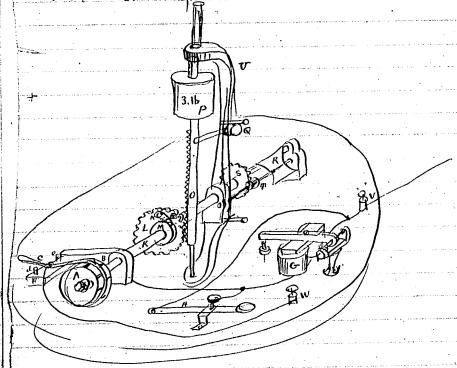
Jos F Murray





The object of this invention is to communicate different signals automatically from a number of machines on one circuit and to record & indicate such signals at a central point. The signalling machines being placed in private houses etc. at a number on one circuit connected to a Central station, and are to be used for instantly summoning the police or a messenger.

The invention consists in a several combinations of Mechanism to effect the object automatically, the Combinations that can be made to perform this operation are so various, unlike, and that to protect myself I shall describe a large number of ways in which the result may be obtained

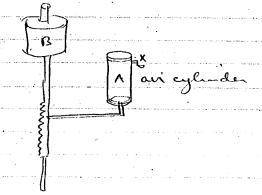


K is a shaft S is a gear wheel T a pinion wheel with a fan R on it. This fan being used to regulate the speed of the shaft K. L is a loose gear wheel carried around by the milled wheel M & click n by the rack O. The rack deriving its power from the weight P. The weight being thrown up by the finger Q is the handle by which this weight is lifted

The handle movement is limited by two limiting pins. It is obvious that if the weight is raised to its full length that the shaft K will remain stationary while it is being raised owing to the position of the click x and when it is allowed to descend it will commence to rotate the shaft K with a certain speed governed by the fan R.

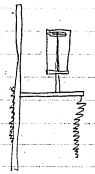
On the end of the shaft K is a double break wheel A with a reversable contact point C secured to the hard rubber stud B the point being limited by the pins d & e. One of these wheels is provided with characters which will open & close the circuit in a manner to indicate "Police" at Central station & also the number of the house the other wheel will indicate "Messenger" after the same manner. When it is desired to call police the contact point is thrown over on one wheel and the weight raised, in descending it rotates the shaft K once thus giving the signal. H is a key connected in the main line G is a test magnet when you are about to give a signal the key is depressed and the main current allowed to circulate through the magnet G which if it remains closed for a small length of time shows that no other signal is being sent when the key is raised the magnet cut out and the weight raised and in descending the signal is transmitted

I do not wish to confine myself to a fan for regulating the speed of the shaft K or the descent of the weight as it can be done by air thus:—

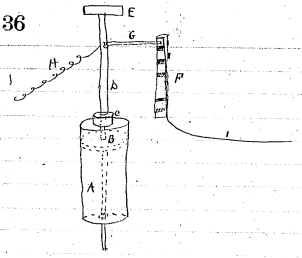


B the weight A. a very tight air cylinder with a piston within it. The piston connecting to the rack & weight when the weight is raised sufficient extra power is applied to force the air out through the small hole X. but when descending the power of the weight can only force it out slowly and consequently it falls slowly.

The weight might be dispensed with and a spring substituted thus.

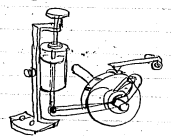


The rack break wheel and its parts might be dispensed with and the same thing accomplished in this way thus:—



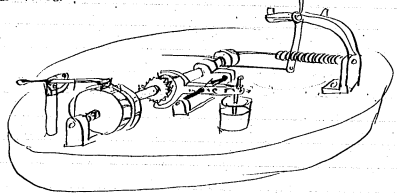
A is a cylinder with a rod D having a head B in this cylinder. E is a knob or handle & serves both the purpose of raising the Rod D and as a weight to force the air out of the cylinder as the piston head descends. G is a Contact spring rubbing on either side of the Signal Bar F. as the case may be, ~~this~~ When it is desired to give the Signal upon the Circuit the Rod D is raised to its full heighth and the Spring G rubbing on either side of the signal Bar or Contact lever F makes & breaks the circuit as the rod slowly descends as it will owing to the force necessary to ~~force~~ expel the air which being greater than the effect of the weight of the rod & the knob E.

The Contact may be made in this manner

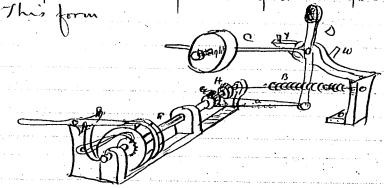


The downward movement of the piston rod moving the Contact wheel a short distance around, four or five Signal being made in one revolutions, and one full signal being upon the segment of the Circle moved.

The air cylinder may be made to regulate the speed of a shaft which may derive its power from any source, The object mainly being to dispense with as many gear wheels as possible or with them entirely, The manner of regulating is thus :—



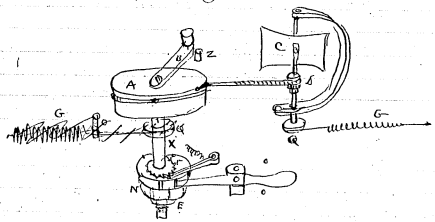
The air cylinder might be dispensed with and a spring attached or a ball might be attached to the End of the Vibrating lever i.e. The form of the teeth which gives motion to this lever can be made in a ratchet ~~form or~~ star, or wavy former The ratchet wheel and Vibrating arm might be dispensed with by making ~~it~~ a governor in this form



F is the shaft ~~H~~ H ~~on two~~ small pulleys a is a cord worked by the lever D, B is a spiral from which the power is derived ~~The spring is provided with a cord where it goes on the pulley H. it being on top and wound in opposite to that on G.~~

C is a weight which is used to regulate the rotation of the shaft F. When in its normal position the Lever D is at the point W, but when a signal is to be given by the rotation of the break wheel The Lever is pulled over by the hand from to Y and this act ~~stores~~ winds up the spring but does no turn the shaft on account of a click which prevent it going backwards, the act of moving this Lever by the hand stores up the power in the weight and when the lever is let free by the hands the shaft commences to turn slowly according to the distance of the weight

There is still another mode of governing the rotation of this shaft, without gears Thus

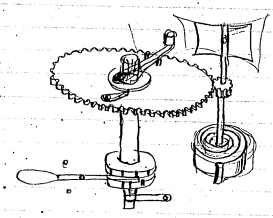


A is a drum upon which is a handle B this is secured to the shaft X. Q is a small pulley on which the cord of the power opq G is secured N are the two break wheels carried around by friction on the shaf X by a spring washer & bolts at E. C is a governing fan connected with the drum A by a Cord

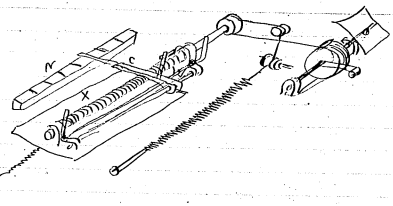
By turning the handle B from 2 to 0. The spring is wound up and when the handle is free ~~to go~~ The shaft commences to turn but cannot go fast as the fan

an large size of the wheel A prevents it.

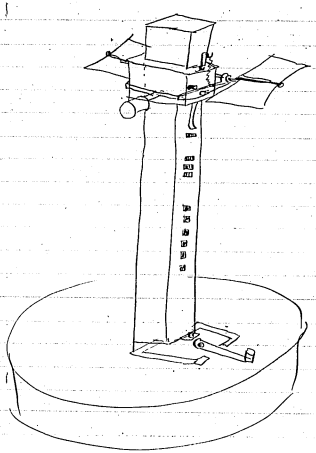
A single gear and flat spring might be used in the following Manner

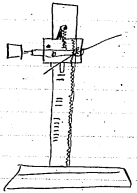


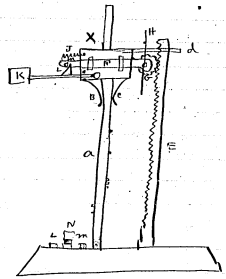
This is another form in which a governor which can is not very necessary. or sights -



X is a screw C a traveller N the break pieces when the drum is wound up the shaft or screw revolves very gradually and the traveller goes over to the other end making the breaks on N. When it gets over it throws a little wire up which throws it out of the thread and is drawn back home on this wire by a equal spring -

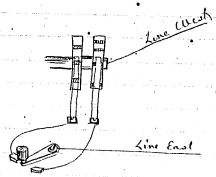




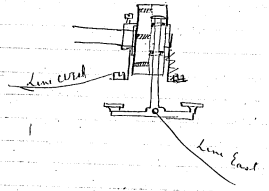


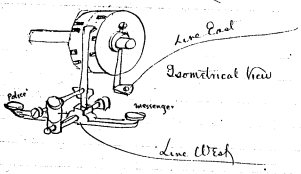
a is a rod of insulating Material with the character sunk in on each side B & C are the contact springs d is a spring which rubs on the side of E and through which the circuit is conducted from E to the Square X. K is a handle pivoted on X ~~and has two limiting~~ and has a Limiting pin to prevent it from falling.

G is a pinion having a fan H screwed to a Slide F, and is thrown out of the rack E when the handle K is lifted in the act of raising X to the top of A from the bottom is thrown back in the rack by the spring f when the handle is released then the block X gradually drops to the bottom with a speed governed by the size of the fans H H. The Contact Spring B or C making a signal by coming in Contact with the side of a The side which shall act being governed by the electric Switch L M N N Bring the bottom connected ~~to X and through~~ with the line and L to one side of a a M to the other



Manner of working the Double break





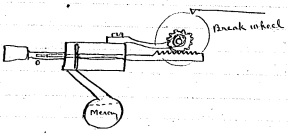
About Signaling Machine

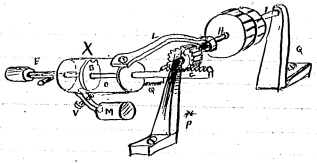
Jany 15 1872

Witnessed Samuel Edison

T A Edison

Here is quite a novel and simple arrangement for performing the ~~arrangemen~~ operation



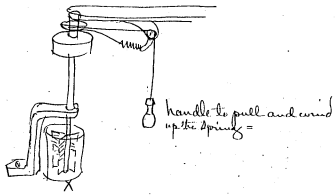


X is a cylinder B a plunger with a rack G on it working in small gear wheel K on main shaft I which has break wheels H same as described before, Q is a spiral to pull the rack back when at rest, the signals where be provided with devices for carrying only one way. L is an arm to which the cylinder X is fastened. The arm swings on the main shaft. M is a small cylinder in which the mercury runs when the cylinder is tipped up as shown, Now if we wish to rotate the signal wheels shaft we take hold of the handle F and let the two cylinders drop by gravity so they stand upright, the moment they do so the mercury from the small cylinder runs ~~into~~ slowly into the large cylinder, (the rapidity with which it runs being governed by a taper screw V) and acting on the head of the rack plunger slowly raises it and rotates the

Shaft & break wheels one revolution

Now by returning the cylinder to the position shown in the Drawing the Mercury runs by ready for the next signal

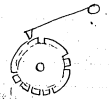
I obtain another slow motion of the shaft carrying the break wheels by putting a fan on it and running this fan in a tube filled with Metallic Mercury.



X is the tube filled with Mercury

I shall now describe the means of indicating the signals & recording the same in the Central office

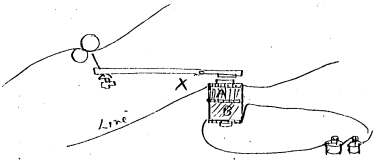
As all of the breaks wheels must necessarily stop on a closed circuit to bring out the signals properly upon an ordinary Morse register a slight alteration is necessary.



The break wheel to give the signal 1 2 5 is made in this manner one break for 1 two breaks for 2 and five breaks for 5 and then the wheel stops on a closed circuit

The signal to be plain should come from the Register in this form

This is done after the following manner



The magnet X of the register has a double set of helices, through one which a local passes constantly and through the other the main. Now when both are closed they neutralize each other, and no mark is made on the paper, but when the break wheel of any machine is started every time an opening occurs the main line current ceases in one of the bobbins for an instant and the local acting brings the lever up and indents a dot, when two breaks follow quickly 2 dots & so on

The dots may be recorded in this manner by polarizing the magnet in such a manner that when the main line current circulates through it it neutralizes the effect of the polarization for the time being but when interrupted for an instant the polarization of the magnet is

sufficient to indent a mark upon the paper
I do not wish to confine myself to an particular
Machine for recording in this Manner
As an Ink recording Machine could be used
or Chemical paper, etc.,

It can also be printed out, I do this in following
Manner,

EXPERIMENTAL RESEARCHES

The six books in this series cover the period October 1875 - March 1879 and consist primarily of laboratory notes by Edison and Charles Batchelor. They also contain laboratory notes, caveats, and patent specifications, which were copied into these volumes by Edison's bookkeeper, William Carman. The notes and drawings deal with electric lighting, telegraphy, etheric force, the telephone, the electric pen, the electromotograph, electric motors, batteries, ore mining, and miscellaneous chemical and electrical experiments. One volume, in Batchelor's hand, contains eight "axioms." The following books comprise this series:

Cat. 994	Vol. 1 (1875-1876, 1877-1878)
Cat. 995	Vol. 2 (1878)
	Vol. 3 (missing)
Cat. 996	Vol. 4 (1876-1877, 1878)
Cat. 997	Vol. 5 (1875-1877, 1878-1879)
Cat. 998	Vol. 6 (1878)

Experimental Researches, Vol. I, Cat. 994

This notebook covers the periods October 1875-January 1876 and May 1877-October 1878. The entries on pages 1-60 are in the hand of Thomas Edison and Charles Batchelor and deal with the electric pen and duplicating press, etheric force, polarization, ore mining, batteries, chemical experiments, celluloid, and acoustic and domestic telegraphy. Some of the entries are signed and dated by Edison, Batchelor, and James Adams; others are signed and dated by Batchelor alone. Detailed drawings supplement the text.

A series of notes and drawings dealing with the development of the electric light has been copied into pages 113-204 by William Carman, Edison's bookkeeper. Pages 205-207 contain a copy of an "electric light law." (The originals of the material on pages 113-207 can be found in Unbound Notebook, Vol. 16 and Laboratory Scrapbook, Cat. 1146.) The book contains 640 numbered pages.

Blank pages not filmed: 62-99, 102-111, 210-640.

Illegible pages not filmed: 208-209.

Nay 6353 A

Black Autographic Ink

No 1

Tried lampblack and castor oil alone ground well in a mortar, it work exceedingly well.
Tried Glycerine and lampblack, dont work well there seems to be an antagonism between the two so that even a mechanical mixture seems almost impossible, the lampblack settles out, by rubbing the roller a great number of times over the stencil paper the ink assumes a very pale look, but if the finger is rubbed over it a dense black streak is seen. another phenomenon is noticed, the blue ruled lines upon the paper appear to repel the ink and show quite white. The mechanical mixture of lampblack with castor oil is so perfect that one would believe that it was soluable, though it is almost certain that it isn't.
The Castor oil-lampblack ink does not appear to blot through the paper enough to prevent the taking of a large number of copies. By placing Castor oil, Olive Oil, Codliver oil, Lard oil and Glycerine upon paper, the Olive oil came through first the Castor oil 4th and the glycerine did not come through for some time, the glycerine used was crude and quite thick though not any thicker than the castor oil. Common printing ink thinned with castor oil works perfectly, and if the printers ink is cheap enough leaves nothing more to be desired. Common printers ink does not mix at all with glycerine, at least there is an exceedingly poor mechanical mixture.
Powdered proto Fe and nutgalls put together and ground with glycerine gives a fair ink but has not a sufficient depth of color to be satisfactory. The most

perfect and conspicuous copies ever taken on the Autographic press were taken this evening with ink formed of printers ink skinned by castor oil and ground on a mortar some two weeks previously.

October 3. 1875 Thos A Edison.
Chas Batchelor. James Adams

No 2 Electrical Pen

In testing a new model pen this evening, one with all the mechanism put on an iron frame (cast) we found that it did not approach in power or speed the rubber frame pen made by John Ott, the spools of the iron frame pen were two sizes of wire longer than Otts magnets, thinking perhaps that the resistance was too great or that owing to the greater number of convolutions the self induction delayed magnetization we unwound one layer from each spool, but this did not appear to increase the power or speed materially, we then tested R on Galvanometer of both pens & found them about the same. We used the cast iron frame as a yoke to the engine magnet and found by testing that there were free poles at the points where the cores are connected to the cast iron back, these free poles became nearly as strong when the armature was in contact with the regular poles, as the regular poles. We then in addition to the cast iron yoke inserted a small soft iron yoke about $\frac{3}{64}$ thick, this made some differance in the speed still there were free poles; We then took the magnet out of the Engine frame for testing, found that with the small soft iron back there was scarcely any free poles when the front armature was not in contact with the cores, this armature is $\frac{3}{32}$ thick, but when in connection the free poles were very strong perhaps they would attract with a force almost equal to the regular ones, by making the armature thicker the free poles became stronger If the yoke was increased in thickness the free poles became weaker and it is very probable that

if both the yoke cores and armature had the same mass of metal and all in good contact no magnetism or free poles could be detected but the moment the iron circuit, or perhaps we might call it the magnetic circuit was weakened by decreasing the mass of the iron at any one point free poles would appear at that point, hence to obtain the maximum power the mass of iron in the yoke should be so great as to offer but little resistance to the passage of the magnetism so as not to cause free poles, thus compelling the poles to go to the point of greatest R. those in front of the armature, and it may be found that a thin armature will increase this tendency by increasing the resistance We also discovered a Phenomenon, thus with a thick armature and back or yoke considerably thinner a nail was attracted only on opening and closing the circuit further tests should be given this and the armature & yoke proportions.

Oct 6th 1875, all night

Thos. A Edison
Chas. Batchelor
James Adams

Autographic Pen

No 3

Worked on pen all night - (model pen) found that cams gave vibrating pen too great a movement (ie) three times more movement than was necessary to puncture the paper, hence engine had to do more work, altered it so that it would give much less movement, There was a great improvement in the speed of the engine, but not enough to account for the unsatisfactory working of the pen, we tested

the spring contact also on setting the armature in various positions.

Chas Batchelor
James Adams

October 7th 1875

No 4 Autographic Pen

Went at model pen again, found that the trouble was principally in the back center screw, it was cupped too deep, and the magnet pulling the armature towards it made a great friction, not noticable when there was no magnetism, had a small center hole put in the screw, and the pen at once went perfectly satisfactory. Also took out the magnet wound with founder wire and rewound them with finer wire, perhaps three sizes smaller, then engine went still faster, and the pen appears to be the most satisfactory yet produced. Two inductorium cells do not work it satisfactory. on all nights =

Thos A Edison
Chas Batchelor
James Adams

Oct 8th 1875

No 5 Nitro-cellulose = Kid

The celluloid Co proxlin containing a considerable quantity of Chloride lime and perhaps some free SO_3 was found readily soluable in proxylic spirit, in the cold. even after so much proxlin or nitrocellulose had been added that it assumed the consistancy of dough. It would still continue to dissolve more.

Phenomenon after it is thus dissolved it is easily and entirely soluable in Water. a thin solution of which makes an excellent glue for fastening paper together, as the substance has an intense acid reaction. I am inclined to think that the proxylic spirit is turned into acetic acid which is an excellent solvent for proxlin. I tried to vulcanize it by adding flower of sulphur and heating it in an iron watch glass dish = failure — It does not mix with gutta percha dissolved in Carbon Bisulphide

Thos A Edison

Oct 8th 1875

No 6. Autographic Pen

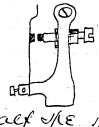
Our original pen was faulty in these respects, hard rubber was not a suitable material for the frame and the whole pen was too expensive to manufacture, no two pen acted or were alike some would go right off and make a much larger number of revolutions in one minute than others, and work on a spent battery when others did not.

We made a pen with an iron frame and it did not go well and for a time we thought the iron must have something to do with it but we have since found that it has no effect.

We made a frame of brass and new parts and found that it did not run as well as some of the old pens.

after considerable experimenting found following

1 The centres must be small,
2 The back centre must bottom thus
3 The front centre must be thus
4 Both centres and screws must be hardened steel
5 The wire on the magnets must be No instead of No..
6. The cam must be of steel
7. The cam clip must be of steel
8. The contact vibrating spring must have a piece of platina wire thus



9. The armature must be half the thickness of the keeper
10 The needle must have a very long taper, not blunt
11 The cam must not move the clip but very little sideways,
12 The needle must be soldered to rod
13. Centres must be very true to prevent armature from approaching magnets eccentrically
14. All wearing parts must have a looking glass burnish.

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15 The cam should vibrate the needle just enough to pass through the paper (ie) the length of this line 1.

October 14 1875

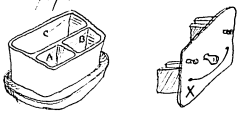
Thos A Edison
Chas Batchelor
James Adams

Batteries

No 7.

We have experienced considerable trouble in obtaining a suitable battery to run our Autographic pen. The French Grenet battery are easily tipped over and the rod which serves to raise and lower the zinc in the liquid becomes stuck in its holder by oxidation and by crystalization of salts. In order to obviate this objection we made a model of wood intending to make it of earthenware or glass like figure 2.

Fig 2



The appartments A and B for the battery and C for dripping when the cover X has been lifted up and turned around and the battery is not in use. We found that it was almost impossible to get the compartment jar made of earthenware, it contracts so much that the partition would seperate from the side, however a party in Trenton said he would try and make them for $1.25 each. We next went to the glass people found that the mould would cost $125.00 and the glass moulded with cost 25c per lb at lowest.

We then thought of making the cell shewn in fig. 1. of cast iron placing glass cells in A B and C. also of forming the cell out of sheet hard rubber by mould and hot water or oils.

Also of taking two Grenet Batteries and placing

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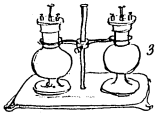
them on a stand as in fig 2

Fig 2



which brought in another idea of putting two glasses upon a stand (iron) as in fig. 3. and letting both the zincs and carbons out using a porous cell. The glasses set in the iron base 1 inch the carbons are copper plated and soldered to the connection pieces. The zincs have a screw cast on them all fastened to thick rubber disks which are in turn fasted to an arm connected to the upright rod. The battery is shewn in fig 3

Fig 3

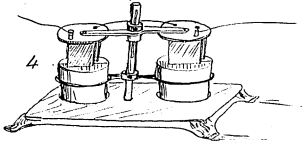


Fig 4

Fig 5

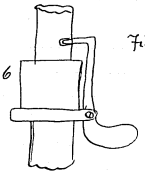


Fig 4 shews the porous cup fig 5 a catch for holding the elements out of the liquid. The arm carrying the elements is prevented from turning by a key seat in the upright in which a screw runs which can be used if necessary to hold the arm in any position in place of the catch shewn in fig 5

We propose to use electropoin of great strength in the porous pot.

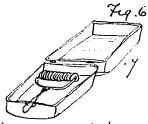
October 14 1875

Thos A Edison
Chas Batchelor
James Adams

No 8. Ink distributor

We find there is wanted some place whereby the ink for the autographic press may be put on the roller This is shown in fig. 6.

Fig. 6.



The bottom on which the ink is spread is an inch board with its grain at right angles to the handle of the roller so that should it warp it will not prevent even distribution

October 14. 1876.

Thos A Edison
Chas Batchelor
James Adams

No 9. Batteries

Put up two 1½ ordinary electropoin batteries. with porous cell and ordinary fluid. Started new iron back pen running at 7.30. PM Oct 14th at 8 AM Oct 15 it was running as fast as when started and writes as well. no perceptible darkening of the fluid in porous cells, but found that the needle which is placed in a slot in rod works loose. on Oct 15 6 PM Engine still running fluid apparently as yellow as ever. 8 PM. Engine running good and strong 1 cell containing 1½ carbon turned black No 1 Carbon cell still yellow Oct 16 9 am Engine running very slow both cells black and run down

October 16 1875

Thos A Edison
Chas Batchelor

No 10 Polarization

Solutions and substances to depolarize negative element of the Hydrogen (Wird)

Solution Sal Ammoniac and small quantity of Sesquichloride of Iron on No 4 strap of a Bradley Tangent galvanometer First closing 20° in one minute 15° shaken moderately goes to 35° shaken more 40° more 45° shaken violently needle goes to 90° - Carbon & Zinc electrodes, French = Electrodes placed in Chloride of Calcium, on closing needle goes to 10° shaking makes no difference = Electrodes soaked in Chloride Calcium then dipped in strong NO_3 to precipitate the gypsum on Carbon, doesn't apparently do it. on closing, needle goes to 50° in 1 minute 30° shaken violently goes to 52° =

Zinc covered with Castor Oil and immersed in a Solution of Ferric Sesquichloride and Ammonic Chloride needle goes to 18 in one minute goes to 19° in 2 minutes 20° 3 minute 21° in 5 minutes needle goes to 23° when battery well shaken stands at 30° then goes back and stops at 26½° shaken again goes to 32° then goes back to 28° =

Both Zinc and Carbon covered with castor oil on closing needle stands at 30° in one minute stands at 27 shaken violently goes to 45°

Z covered with Olive Oil. in same solution as above on closing 20° in 10 seconds goes down to 15° when shaken violently goes to 40°

Zinc coated with Balsam Fir needle on closing stands at 20° one minute goes to 6° shaken violently goes to 35° then drops to 6°.

Zinc coated with Cod Liver Oil when put on zinc turns white on closing needle stands 30° in 10 seconds 9° shaken goes to 40°.

Zinc coated with Gum Arabic, closed 30° goes to 17° in five seconds

Zinc covered with Grape Sugar closed 30° in 10 seconds goes to 20° two minutes 18°

Zinc covered with silicate of Soda, (Water glass) closing 40° 20 seconds goes to 20° Shaken needle goes to 60 then drops in 20 seconds to 20°.

Zinc covered with Collodion, on closing needle stands 45° goes to 20° on shaking seconds on 1 minute 18° and stands permanently at 17½°

Zinc and Carbon Covered with Collodion. on Carbon there is rubbed in the Collodion Black oxide of Manganese (powd) on closing 50° in 30 seconds 30° stops permanent at 29.

October 16th.

Thos A Edison
Chas Batchelor
James Adams

No 11 **Battery Fluids**

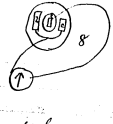
No 1½ Carbon alls zincs unamalgamated

No. 1. $KOCrO_3$ 8 parts SO_3 15 parts HO 20 parts ordinary red fluid closing at 9.40 PM 30° See table page 11.

October 17th 1875

Thos A Edison

No 12 **Polarization**



An extra carbon is placed in the outside solution and connected to the zinc thus forming a battery. these are used as one pole the Carbon in the porous pot as the other, When you break the circuit between the Carbon in the outside from the zinc Galvanometer goes up 1° by putting Extra Carbon inside porous cell with the other carbon but not touching it needle runs from 82 to 43

See Vol 5 p 4.

October 19 1875.

Thos A Edison
Chas Batchelor
James Adams

No 13

Battery Fluids

No 1½ Zinc & Carbon 50 3 in outside unamalgamated

Bradley Gal = 50 op - 20 R No 4
Tangent

No	Formula	Closing	Op	Sp	Op	Sp	Op	Sp	Op	Sp	Time	Remarks
1	$NiCr_2O_7$ = 5 parts SO_3 15 parts HO 20 parts ordinary electropoion fluid	PM 9.40	30°	3.27	20°	9.33	13½				Hays 5	
2	$KONO_3$ = 5 parts SO_3 15 parts HO 20 parts	9.20	0°	2.25	37½	5.19	23°				1.24	17½
3	$KOCrO_3$ = 5 parts NO_5 15 parts HO 20 parts ordinary	9.14	28°	4.18	20°	4.57	21½				1.30	10½
4	$KOCrO_3$ = 5 parts NO_5 15 parts SO_3 15 parts HO 20 parts	10.20	30°	5.30	9½	9.30	5.33	43	1.40	17½		
5	No 12 5 parts SO_3 15 parts 20 parts ordinary red fluid	10.03	30	5.30	13½	9.30	5.33	13½				
6	Ce Pickle process 5 parts HO 2 parts 1 m 21 2 m 27 3 m 27 3 minutes 47	1.25	27	2.33	13½	3.30	13½		1.34	14		
7	Zinc management TK 5 parts SO_3 15 parts HO 20 parts	1.25	24	2.34	24	4.45	1°		1.40	3		
8	$KOCrO_3$ 5 parts SO_3 15 parts HO 20 parts	1.14	17½	3 m	41	4½	12°	4.46	11°		1.40	11½
9	$KOCrO_3$ 5 parts SO_3 15 parts $NaCl$ 5 parts 1 m 42½ 1 m 42 3 m 41	1.34	25°	3 m	25°						1.40	13½
10	Bichromate K 5 parts $CaONO_3$ 5 parts HO 20 parts 1 m 34 1 m 42 3 m 47	1.35	40°	4.46	27°						1.44	3
11	Chromate K 5 parts SO_3 15 parts HO 20 parts 1 m 40 1 m 42 3 m 47	1.40	25°	4.47	10°						1.46	19¾
12	Bichromate 5 parts SO_3 15 parts HO 20 parts 8° 1 m 9 3 m 10½	2.20	10½	4.43	38½						1.48	21
13	$KOCrO_3$ 5 parts SO_3 15 parts HO 20 parts 22 1 m 25½ 3 m 25½	2.11	25½	4.30	20°						1.49	22
14	$KOCrO_3$ 5 parts SO_3 15 parts HO 20 parts 54 1 m 52 3 m 50½	3.59	50½	5.30	27°						1.53	26
15	HO_2 85° one minute 56 1 m 56 3 m 3½	7.17	3°	8.35	16°						1.54	16
16	$KOCrO_3$ 10 parts SO_3 5 parts HO 20 parts 45° 1 min 45° 3 min 44	3.55	96°	5.20	60°						1.59	10
17	$KONO_3$ = 10 parts SO_3 15 parts HO 10 parts	4.15	44°								2.44	9
		5.30	53°								1.54.44	1.30 17

Oct 17

Oct 18 1875

Accepted

Thos A Edison
Chas Batchelor
James Adams

Bradley Gal straps No 74 — Battery Fluids — 1½ Carbon, = Telegraph Cells

October 19th 1878

No									
1	$KONO_3$ 10 parts	SO_3 18 parts	HO. 20 parts.						
2	Same as No 1.								
3	Ordinary Electropoin Q.S.								
4	$KONO_3$ 8 oz	SO_3 1 lb	HO 3 lbs weight						
5	$KONO_3$ 5 oz	SO_3 8 oz	4 oz	HO 10 oz					
6	Same as 5 except KO_3 8 oz								
7	$KONO_3$ 1½ oz	$KOCrO_3$ 1½ oz	SO_3 7½ oz	HO 20 oz					
8	Same as 7 except SO_3 10 oz								
9	" " 8 with 1 oz more each $KONO_3$ + CrO_3								

am 11.15	60½	313	42	
am 11.16	62	316	52	am 333 45½
am 11.30	58	320	44	am 335 30
am 11.35	54			337 26½
am 11.37	29			338 25½
255	59			338 47½
310	52			am 6.00 27
341	52			601 23
am 4.00	52			550 33

No 3 was probably not well short circuited.
No 1 Had defective porous cell, made a difference of 10° found out by changing Z. C. Fluids etc.
No 4 polarizes 10 degrees in 3 minutes
No 5 " 3 degrees in 3 minutes
No 7 " 3 " in 4 "
No 8 on closing 20° in one minute 30 in two minutes 38 in 3 minutes 40, changed porous cell went to 50 + mm 52
Found that a dry old porous pot would give full strength in 5 minutes. The pots vary greatly in resistance which is especially noticeable on very short circuits =
No 1 showed have more HO The salt Crystalize on the Carbon pole besides an image in bottom porous pot

All night

Thos A Edison
Chas Batchelor
James Adams

Plumbing Process

Use the autographic pen & punctate the lots in the paper to form the drawing, writing etc. Wet the paper, or use paper previously made impervious to moisture by varnish or shellac or other material, or tin foil by other metallic foil. Lay the punctated sheet of tin foil or perforated paper upon a polished surface. Being a frame work down into it & pass in liquid plaster of Paris, pouring the same upon it & rub the weight of the extra plaster of Paris will force it through the holes. After it is thoroughly dry take the paper & separate the paper from it either by pulling off or dissolving in H_2O_2 or burning. Engraved Shellac, rolling wax or any substance that can be fused upon the paper then the paper in a liquid or semi-liquid state & hardens by time heat or other means will do.

Note the plate is dry it is coated with plumbago or other conducting substance. Wet by electrotypers & place a non-conducting substance a conducting surface, & then put on a blasting fork & electrotype on the usual manner, & it may be done in 5 minutes from chisel.

The punctated sheet done by the autographic pen may be used like a broken stencil machine in stereotyping, the stencil being placed on a metal & the metal forced into it, the pressure of the wax metal at the top of the metal covering to force it through every punctured hole to the smooth surface of metal underneath, when the metal is removed it is taken out the paper & stripped from it & blocked, it is then ready for printing on the usual manner.

The punctated paper prevents any metal & hands effects of glue on it by friend Edison

hardenings that it did not go through the holes owing to them being closed up by the water swelling the paper

We tried pouring lead on a stencil but it did not go through the holes, we then poured through a funnel shaped tube like Fig 1 so that we could get a body of metal to press it in. In this manner we could see the shape of the letters on the lead & there is no doubt that with care & lots of pressure we could get it perfect. We tried putting stencil paper on flat plate of Zn. & fastening down with beeswax, then making a beeswax embankment around the writing & pouring in Hg but with little success as the holes seem to be too small for it to get through

Fig 1

9

We also tried copperplating through the holes to get a raised surface on the metal to print from

We tried writing with common ink & shaking plaster of paris on it to form a hard insoluble substance to print from. it raises it up pretty high but it is probably no good

Paraffine apparently goes through the holes & we took a good print from it

Oct. 19th 1875

Thos A. Edison
Chas. Batchelor
James Adams

No 16 Batteries

In order to dispense with porous cell we tried the following:-

10

X is a glass cell filled with electroporion.
N is an ordinary battery jar in which is H_2O as high as ½ of an inch above the top of the electroporion jar. The theory being that the ½ of an inch of H_2O above the electroporion in the glass cell X will serve as a conductor between the outside & inside solutions dispensing with a porous cell & that the rate of diffusion will be so slow that

that the electroporion will be exhausted before enough SO_3 comes over into the outside solution to attack the Zn strongly. Jar used for outside 1½ carbon, 2½ (cut battery) cell for X put on at 11 40 PM

Thos A. Edison
Chas Batchelor
James Adams

Oct. 19th 1875

No 17 Mining Ores.

To ascertain if a vein of smelting (ie) earthen ores is a pocket, connect an earth plate making good connection with the general earth to a telegraph wire of known resistance the end of the wire being at the mouth of the mine, which mouth must be soft earth all round, the wire is run into one end of a test battery thence to a galvanometer & wheatstone bridge thence to a large plate (of given size previously tested together with other plate & wire in general earth) inserted in the body of ore in the vein By a little experience the fact that the vein is or is not a pocket can be determined also its size & richness. As the salts or oxides of the metals are better conductors than ordinary earth of the vein is a pocket the body of ore might be determined by charging the whole body statically or by secondary battery action.

Of course in these tests the condition of the country geological formation, hygroscopic condition, the nature of rock & ore must be taken into consideration as well as many electrical points.

In a Quartz vein with walls of rock containing little or no moisture the ore being one mass of stained rock (ie) finely divided, the test can be made by charge, condenser, etc.

The H_2O oozing from the rocks of suspected localities might be tested with spectroscope to detect soluble chlorides of gold & silver salts.

the different parts of the rock showing different quantities from which the lay of the vein may be got by calculation.

We find by experiment that if porous earthenware is held on the tongue it soon clears it of all H_2O & the force of capillary attraction locks the tongue to it so that it is painful to separate it.

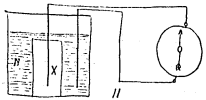
This principle may be useful in mining ores in the following manner:- take earthen ore & roast it to turn the silver into a hygroscopic salt; it is then exposed to the air till it is moist, & afterwards thrown onto large trays or cylinders of porous earthenware when the silver salt will stick by capillary attraction & the sand & silica will not

Oct 19th 1875
12 P.M. Midnight

Thos. A. Edison
Chas Batchelor
James Adams

No 18 Batteries

In experiment on batteries Page 14 we found at 2.25 AM Oct 20th that scarcely any of the electropoion has come over from X into N showing that this plan is a success as far as mixing of fluids is concerned.



We now put a carbon & zinc & found it only gave 7° on Nat of Bradley galv, showing a great deal of resistance in the fluid that connects X & N

the Zn is attacked fiercely at a point in a line with top of X showing that SO_3 is coming over.

Oct 20th 2.25 AM

Thos A. Edison
Chas Batchelor
James Adams

No 19 Porous cups

Tried plaster of paris to make porous cells, can make very beautiful ones but as yet do not know

whether they are porous enough. Hardened plaster of paris which had only been set 1 hour softens immediately if dipped in $SO_3 + H_2O$ that dissolves paper. Plaster of paris which had been hardened 2 hours & had originally les H_2O only softened slightly, it is probable that if thoroughly set say 24 hours $SO_3 + H_2O$ would not have any effect. the SO_3 acts by depriving the $CaSO_3 + H_2O$ of its H_2O which chemically combined with the $CaSO_3$ when mixed

We attempted this morning to make porous cups from some clay from Long Island which was supposed to be capable of being used for Portland cement. it works very well & we may perhaps succeed in baking it properly

Oct 20th 5 A.M. 1875

Thos A. Edison
Chas Batchelor
James Adams

No 20 Mining

On a zinc plate moistened slightly crystals of $CuOSO_3$ stick quite strongly, the Zn reducing the $CuOSO_3$ to $ZnOSO_3$ & metallic copper sticking it.

Hy-Silicic Acid mixed with Pt Cl. placed on a Zn plate does not stick

Tried wetting paper with H_2S & putting on Pt Cl mixed with Hy Silicic Acid. no good

Ditto with Becberin & Na Sil.	no good.
Ditto with Mn SO_3 & Na Sil	no good
Ditto with Hg Bichl. & Na Sil	no good
Ditto with Na Suphs Cuid. & Na Sil	no good
Ditto with KO, Acitate of Alumum & Na Sil	no good
Ditto with Alumum Cl & Na Sil	no good
Ditto with KO.	no good

We tried the following experiments, mixed with some dirt off street, sand, etc a small quantity of Ca carb. then put it under the prime conductor of a plate glass machine & all of the carbonate of Calcium was separated from the sand adhering to

it, the sand was attracted but of course fell off. Also tried Sulphide of Cadmium mixed with NaCl both powdered. The cadmium sulphide was readily separated from the NaCl, we proved it by testing what stuck & what fell off with Ag NO3. That attracted shewing but faint trace of NaCl. while what remained gave dense white pp. of AgCl.

We tried the regular Utah ores powdering it & attracting with machine. the fine stuff attracted was acidulated with HCl & chloridize the Ag filtered & dissolved the AgCl in Na Hyp: sulphite & precipitated with HCl. This experiment was a failure as the addition of HCl & Hyp: Na precipitated S & disguised the AgCl.

Oct 21st 11 PM 1875

Thos A Edison
Chas Batchelor.
James Adams

No 21 Mining Ores

Tried dirt, brass filings & fusible metal dissolved in hot water, idea being that the fusible metal would act as an amalgamator instead of Hg. It was not a complete success the brass filings stuck to the surface very thick & free from earthy matter, but on breaking the globule of fusible metal very little brass was found inside

Oct 22nd 12 midnight 1875

Thos A Edison
Chas Batchelor

22. Battery Fluids.

NO5	1 Part,	SO3	3 Parts,	8.45 PM.	40°,	2.15 AM,	21
Pb NO5	½ oz,	NO5	4 oz,	SO3	4 oz, 9 PM,	07,	2.15 AM. 14
NH4Cl. nitride,	H2O inside	Hop Ac.	2 Stick,	9.25 PM,	21	2.15 AM	9

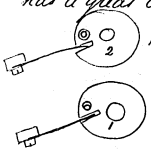
Oct 22nd 1875

Chas Batchelor
James Adams

23 Domestic Telegraphy.

On Domestic Recorder I noticed a very thick black oxide formed which prevented the marks. Paper was ordinary Pyrogallic solution. When rubbed off with fine emery paper the nickel went off with it & it looked as if had oxidized the nickel or it had been dissolved at that point. When the escape wheels are not our time in signal box, the signal is irregular thus for box 15 I have got — · ····· , — · — ····
— · — ·· · — · ···· all inside of 10 calls

I find also the setting of the flat spring on segment has a great deal to do with plain & even signalling, when the segment is going up the spring & pin ought to rest as in fig 1 & when it is coming down it ought to be as in fig 2 It must be perfectly free at all times & not clamped sideways nor so large as to fill the slot.



Oct 22nd 1875

Chas Batchelor.
James Adams

24 Autographic Press Roller.

We find the best way to turn rollers of felt for press is to have a tool in slide rest & take a good heavy cut backwards & then let the same cut cut the opposite direction to smooth it up. Then dress it up with sand paper (coarse) on a perfectly straight surface.

They can be rasped down by a regular wood rasp very quick & good but it then depends on the man to make good straight rollers whilst the other making it by tools must make it right

Nov 1st 1875

Chas Batchelor
James Adams

25 Celluloid

Took SO_3 24 „ NO_5 fuming 6 „ H_2O 4 „ & mixed & let them run down to 140° & put a little in a flat dish, then took brown tissue paper cut in strips & then with 2 glass rods kept turning it in the air to keep it cool after saturating it, threw it in large quantities of cold water violently shaking all the time to prevent heating. In this way can peroxidize a large amount with a minimum quantity of acid after washing thoroughly neutralized it with NH_4 & washed & dried it. This was very combustible but insoluble in our alcohol. Probably it has got too much water in it. We found that by addition of camphor it would dissolve also on addition of Acetone, Wintergreen Oil, oil of Myrbane & Spruce & a few other of the essentials Gum Obalanum doesn't seem to work. Thymol dont seem to work. Spruce + Myrbane seem to be the best the latter the better one of the two though not certain. We think the tissue paper ought to be pulped to get it to dissolve good. We called this No 1 sample & commenced to make some more Sample No 2 was wet with acid sent in the form of spray from a reservoir & did not work well it seemed to be eaten up inside & like India rubber out 3 was oiled tissue paper worked in the same manner as No 1

4 was waste in the same manner.

5 We boiled some sawdust in KO & afterwards treated as No 1. 6 was wood paper in the same manner

We now took No 1 (as none of these were soluble under the ordinary conditions) as being the best & proceeded to find a solvent for it.

We found that NH_4I + Alcohol was a cold solvent

$ZnCl$ + Alcohol good hot

Sulphocyanate of Potash + Alcohol partial hot,

NaI good hot

Ebre Acid + Alcohol partial but not much.

We bottled all these to try again

Nov 5th 1875

Chas Batchelor
James Adams

26 Discovery

Experiment; Subsulphate Iron „ & Sulpho-Carbolate of Lime in Alcohol when boiled gives a beautiful purple color, Sub Fe SO_3 ~~alone~~ in Alcohol with Sulphocarbolate of Lime will do it but not so well. There are certain proportions to be used Fe_2SO_3 does not work, Alcoholic tincture of Iron (Mus) gives very light violet tinge.

Nov 6th 1875

Chas Batchelor
James Adams

27 Celluloid

In experimenting on solvents for paper peroxidized by solution in No 25 page 20. we found that

Oil of Myrbane + Alcohol was perfect solvent cold.

Oil of Pennyroyal + Alcohol was good hot

Oil of Sassafras + Alcohol was good hot

Menispermum + alcohol was good hot

Bromide of Sodium + Alcohol good hot

Sulphocarbolate of Soda + Alcohol good hot

Ammonium Rhodan + Alcohol hot

Chlorate of Copper + Alcohol hot

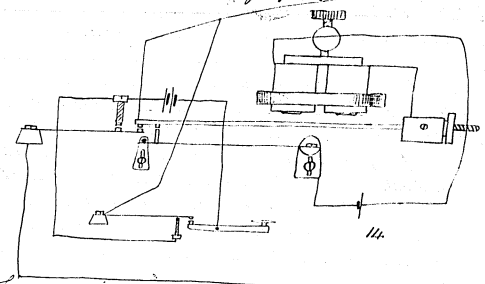
Chlorate of Lithium + Alcohol good hot

Bichloride of Mercury + Alcohol hot

were all solvents as we have qualified them

Chas Batchelor
James Adams

28 Acoustic Telegraphy.

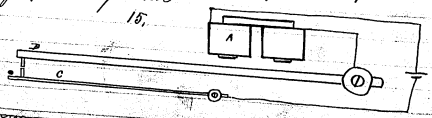


14.

This device has a vibrating rod always vibrated by magnet & local battery with great amplitude & spring. The scheme and works a duplex contact or throwing in & out the battery without breaking the continuity of the circuit & connected in circuit as shewn. The duplex key is used to throw the battery entirely out of circuit which would otherwise be constantly be thrown in & out by the duplex springs in the vibrating bar, not breaking the continuity of the circuit allows us to use a number of separate batteries it also allows the wire to discharge to earth & allows of a condenser at the receiver to augment, quicken & sharpen the waves of current; it also allows us to transmit a greater number of messages, for by Gray's plan 6 message would keep the line mostly closed & of course the sounder to work badly.

We find that the arrangement we made last night gives a perfectly even break with great amplitude of spring & positive position

15.



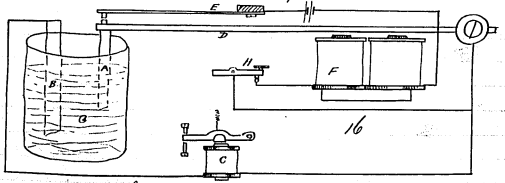
B $\frac{1}{8}$ Stubbs steel wire, C $\frac{1}{32}$ stubbs steel wire. A an ordinary 20 ohm magnet, 2 cells of Carbon battery. 9/16 of an inch motion at the extreme end of bar B perfectly even on closing for a dot. The bar B vibrates in an arc about $\frac{1}{16}$. On making a dash at ordinary morse speed the vibrations reach at least $\frac{1}{32}$ of an inch on making an I at the rate of 15 words per minute it reaches $\frac{1}{16}$ of an inch. of course these extreme limits are not required. A similar apparatus to the above properly adjusted placed in circuit & operated by the breaks from the transmitting instrument answered promptly & vibrated about $\frac{1}{32}$ & we could send at the rate of 7 words per minute but our contact breaker is inferior Batchelor is now making new spring device.

5.35 AM

Nov. 16 1875.

Chas Batchelor
Jas Adams

(29) Depolarization of Batteries



16

We made this apparatus. A is a platina electrode fastened to a vibrating arm of the vibrating mechanism O.D.H. B is a zinc electrode & forms part of the battery of which A is the other pole. The solution is placed in C & the sounder closes, as the battery polarizes, the sounder opens, & we want to find a solution that will close the sounder C quickest after the key H is depressed & the vibrating arm started.

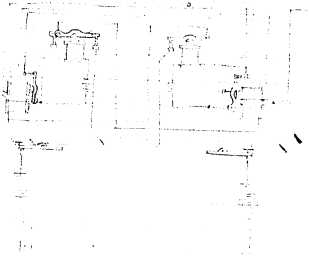
Sesquichloride of Iron & Chloride of Ammonium closes after a few seconds.

Sulphuret Sodium, Chloride of Ammonia & Chloride of Mercury closes after a few Seconds.
Chloride of Ammonia & Ferridcyanide of Potassium closes very quick.
Nov 17th 1875

Chas Batchelor
James Adams

(30) Automatic Repeater

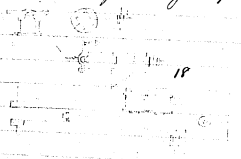
We set up the following idea of Edisons for repeating nothing but ordinary relays & sounders required.



14

(31) Acoustic Telegraphy.

Tried the following experiment -



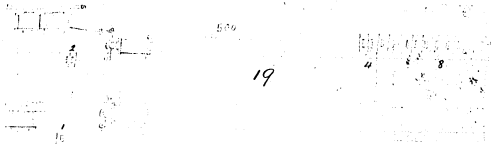
18

N is a secondary battery. The slight closing of X of tuning fork against C vibrates the relay badly but each dot from relay lever & local circuit charges the secondary battery N & closes sounder. When open the secondary N discharges in sounder until next dot & keeps it closed.
Nov 21st 1875

Chas Batchelor.
James Adams

(32) Quadruplex Morse telegraphy

The following experiment whereby increased & decreased currents are made to work a common backpoint relay properly & reversed currents made to work also the ordinary front point relay.

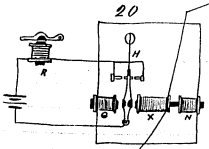


19

This works splendidly & would answer well for a Quadruplex.
Nov. 21st 1875

Chas Batchelor.
James Adams

(33)

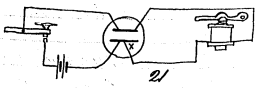


20

This works slow. The sounder works right but if you go fast sounder closes permanently. The induction from N closes C for an instant when X opens keeps R closed X close again keeping R closed
Nov 21st 1875

Chas Batchelor
James Adams

34. Acoustic Telegraphy

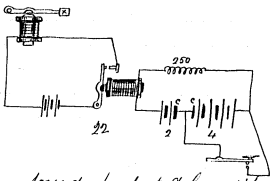


21

This makes a first class sounder dots far apart keeps sounder closed. The longer the dots the greater time sounder stays closed. Good for working by vibration.
Nov. 21 1875

Chas Batchelor.

35 Quadruplex Telegraphy.



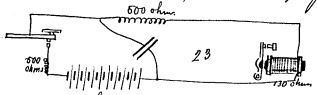
The weight at x dont work well but on closing relay the jump makes the down stroke on the sounder & on opening the other jump makes the back stroke. The writing sounds perfect & beautiful without the necessity of the sounder lever touching the backpoint. This dispenses with the polarized relay in the Quadruplex.

Nov 21st 1875

Chas. Batchelor
Jas. Adams

(36) Morse Telegraphy

With or without resistance; putting a condenser in makes relay work sharp on an adjustment that without it would cause the relay to stick altogether (ie) about 2 secs after opening an ordinary local circuit will say open & no route for relay discharge. Apparently the Condenser sends a reverse charge through relay & kills the residual magnetism.

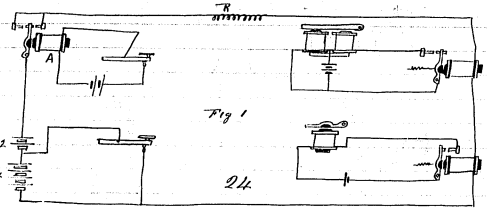


Nov. 21st 1875

Chas Batchelor
James Adams

34 Quadruplex Telegraphy.

The experiment of Fig 1 works perfectly if magnet of A & spring A is so adjusted that it opens & closes in equal time; relay to open & close twice each forward & backward movement of lever of A & all down stroke on sounder works beautifull. The total breakage does not open C so bad as reversals. Shunting B with a condenser makes it worse.



We tried a front point relay at C with total breaks disguised by shunting relay also by shunting sounder & use of secondary battery but breaks show too plain & we must use a polarized relay.

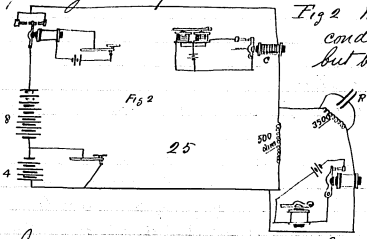


Fig 2 with 1000 ohms in condensers R not good but better than if no resistance or condenser used but when it is made 2500 the dead open relay works perfectly splendid & the backpoint relay works better than when reversed currents are used altogether this arrangement is a grand success.

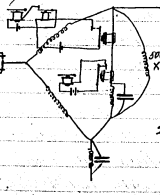
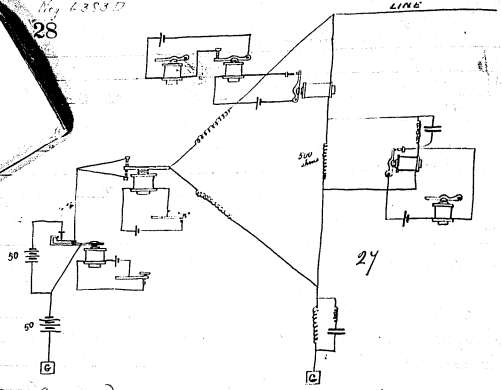


Fig 3 is another arrangement that works splendidly; it weakens back points but makes it work equally as well. Breaking circuit shunt & turns up dead open relay as there is no route for the condenser.

Fig 4 shows one end of the Quadruplex on this new principle.

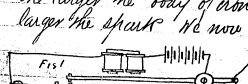


Nov 22nd 1875

Chas Batchelor
James Adams

(38) A New Force.

In experimenting with a vibrator magnet consisting of a bar of Stubbs steel actuated at one end & made to vibrate by means of a magnet we noticed a spark coming from the core of the magnet; this we have noticed often in relays, in Stock printers when there were a little iron filings between the armature & core & more often in our new electric pen & we have always come to the conclusion that it was caused by strong induction, But when we noticed it on this vibrator it seemed so strong that it struck us forcibly there might be something more than induction. We now found that if we touched any metallic part of the vibrator or magnet we got the spark. The larger the body of iron touched to the vibrator the larger the spark. We now connected a wire to x the end of the vibrating rod & we found we could get a spark from it by touching a piece of iron to it & one of the most curious phenomena is that if you turn the wire round on itself & let the point



of the wire touch any other portion of itself you get a spark. By connecting x to the gas pipe we drew sparks from the gas pipes in any part of the room by drawing an iron wire over the brass jet of the cock. This is simply wonderful & a good proof that the cause of the sparks is a true unknown force.

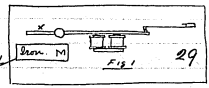
J A Adams

Nov 22nd 1875

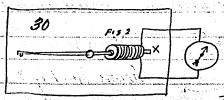
Chas Batchelor
James Adams

(39) New Force.

The following very curious result was obtained with it. The vibrator shown in Fig 1 (Art 38) & battery were placed on insulated stands, & a wire connected to X (tried both copper & iron) carried over to the stove about 20 feet distant. when the end of the wire was rubbed on the stove it gave an splendid sparks, when permanently connected to the stove sparks could be drawn from the stove by a piece of wire held in the hand. the point X of vibrator was now connected to the gas pipe & still the sparks could be drawn from the stove.



Whilst the rod was vibrating an iron piece M weighing about 8 pounds was placed near to X but not touching it in any way or connected to it except by the wood of the base & sparks could be drawn from M with a piece of wire as at W. This would have led to be inferred that that sparks can be drawn from iron bodies in a magnetic field, & that these sparks or force can be transmitted over metallic conductors & do not follow the laws of either voltaic or static electricity.

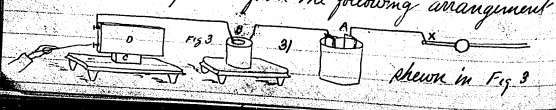


Put a coil of wire over the end of rod X & passed the ends of spool through galvanometer without affecting it in any way tried a 6 ohm spool & a 200 ohm

We now tried all the metals touching each one in turn to the point X with

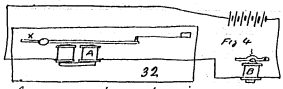
Antimony we got a spark
Lead " " " "
Iron " " " " very good
Carbon " " " " more actinic
Copper we got a spark
Manganese (peroxide) we got a spark.
Platinum we got a spark.
Mercury we got a spark
Tin we got a spark
Palladium we got a spark
Manganese we got a spark very poor
Potassium we got a spark green
Sodium we got a spark
Tellurium we got a spark also a strong & disgusting smell of garlic
Boron we got no sparks
Aluminium we got a spark.
Zinc we got a spark
Cadmium we got a spark good scintillates
Bismuth we got a spark scintillates
Nickel we got a spark
Gold we got a spark
Rhodium we got a spark good
Cobalt we got a spark good
Arsenic we got a spark
Selenium we got no sparks
Thallium we got a spark magnificent green color very actinic little scintillation
Indium we got a spark
Silver we got a spark magnificent green

When standing on an insulated stand we can draw sparks from the following arrangement



shewn in Fig. 3

X is the end of vibrator which is insulated as well as battery A is a secondary battery B is a 200 ohm coil of copper wire, C is a block of iron, & D is a condenser all well insulated except A which is glass & stands right on table.

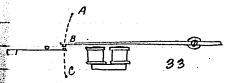


Another magnet B was now put in circuit with the vibrator magnet A & well insulated, a large piece of iron well insulated from everything was now placed 3 inches from A & another the same distance from B & sparks were drawn from both.

Nov. 23 1875 Chas Batchelor
Jas Adams

40 An Optical Delusion

When a vibrator is working & giving a bright spark a curious phenomenon may be noticed. Take two fixed points one at each side of vibrator & about three inches from points & look first at one point & then the other in quick succession & a line of small dots or sparks will be seen on the



periphery of a circle that would be described if the length of the vibrating rod were taken as a radius. If you look across slow towards A the line from B to C will only be seen & as you look towards C the line from B to A but if you look very quick the whole line from A to C can be seen

J. A. Edison
Nov 23 1875 Chas Batchelor.

James Adams

(41) New Force.

We tried our new force over a telegraph wire running from Newark to New Brunswick, thence to New York & back to Newark. We connected X of vibrator shewn in previous articles to the end of line & obtained sparks from the other end of wire with a piece of iron wire held in the hand, showing that this force can be transmitted over long telegraph wires. We then grounded the wire where the vibrator is connected to it & still obtained a spark, showing that this force may be transmitted over uninsulated iron wires buried in the earth for instance the sheathing of the Atlantic Cable.

When we take a spark from the end of the rod X it is much less than when we connect the gas pipe system to it

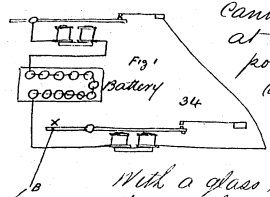
We tried passing the force through water one pole being iron wire connected to vibrator X & the other to gas pipe but got nothing noticeable. Tried solution of Alcoholic Sesquichloride of Iron. Also solution of Protochloride of Iron also a solution of Nitric Acid with no result. Tried Gen. of the organics, Nix with Nitric Acid Nix, Camphor floating in water, Nix. Tried piece of Ferrocyanide of Potassium in Protochloride of Iron, Nix. Tried connecting a large Iron plate weighing 80 lb with X by adhesion, Nix also tried connecting gas pipe for same purpose, Nix.

We found that two iron wires stick together quite strongly probably due to the effect of the spark as the same thing occurs with an electric spark.

We shunted the vibrator with 3 ohms & could get no spark as it circulated in form of Inductive Electricity but could get spark when there was 20 ohms in shunt

By increasing the battery from 8 to 12 cells

we get a spark when the vibrating magnet is shunted with 3 ohms.

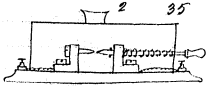


Cannot taste the least shock at A or B yet between carbon points the spark is very vivid as will be seen from Fig 1. X has no connection with anything

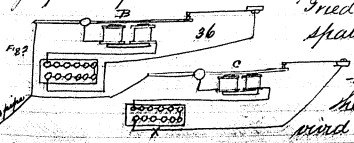
With a glass rod four feet long well rubbed with a piece of silk over a hot stove, with a piece of battery carbon secured to one end we received vivid sparks into the carbon when the other end was held in the hand with the handkerchief, yet the Galvanometer, chemical paper, the sense of shock in the tongue, or a Gold leaf electroscope which would diverge at two feet from an 1/2 inch spark plate glass machine were not affected in the least by it

A piece of coal held to the wire shewed faint sparks.

We had a box made thus:



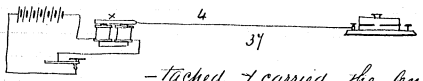
whereby 2 points could be brought together within a dark box provided with an eye piece The points were iron & we found the sparks were very irregular after testing some time two lead pencils were found more regular & pay much more vivid, we then substituted the graphite points instead of iron



Tried Fig 2 but the sparks were not so vivid. We then reversed battery X & the sparks were more vivid but not so great

as when B was used alone

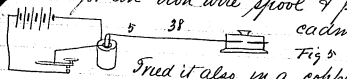
We now found that when we had box in circuit & a magnet operated by a key it would operate as well as a vibrator & with a piece of iron laid on cores at X Fig 3 & the wire at-



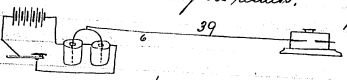
-tached & carried the length of the table into the box we could get the spark every time we opened the key. We tried different metals at X with the following result:—

Iron at X very good
Gold at X good
Brass at X good
Antimony at X very good
Carbon at X very good
Electropoion fluid at X very good
Manganese at X good
Nickel at X good
Copper at X very good
A piece of Coal at X good
Cadmium at X very good in fact Iron & Cadmium surpass all others in this respect

We got an iron wire spool & placed a piece of cadmium inside as in Fig 5 with very good result.



Tried it also in a copper spool of 6 ohms resistance with good results.



We took a piece of No16 copper wire bent in form of a horse-

-shoe & placed it in two spools as in fig 6 & get the spark when the spools are connected so as to give no magnetism we get spark just the same As a magnet having a resistance of about twenty five ohms connected to make no magnetism & placed in a circuit of 10.000 ohms with 20 cells of

1½ Electropoion battery sparks were obtained when the ends of the wire running to the box containing the Graphite points was held across the poles of the magnet by the finger

With 2 ohm spools with horse shoe copper wire put in 15 ohms resistance kills the spark.

With a 200 ohm magnet connected to give no magnetism, but which did give a little, we got spark on 10000 ohms good.

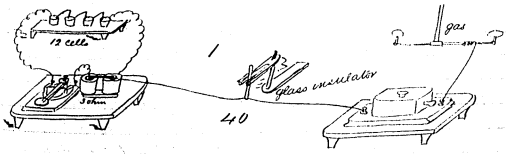
It appears that when the spools are connected to give no magnetism the electricity goes off into this new force and this same magnet I get it with only 12 cells battery & the magnet does not attract a fine iron wire suspended by a thread.

Nov 24th 1875

Jas Ewing
Chas Batchelor
Jas Adams

(42) New Force.

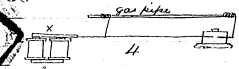
Started experiments in the following manner



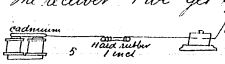
Of course we get the spark splendid with a piece of iron across the spools.

With magnet as in 2 weak spark. A is a 200 ohm magnet. B a 6 ohm spool with an iron core placed in & the two ends of 6 ohm spool together with the core connected to line.

The 200 ohm magnet closed on top with an armature & then the iron laid on that very good.



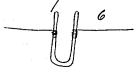
A piece of Cadmium at x & the line fastened to gas pipe on each side of the receiver & we get sparks just same.



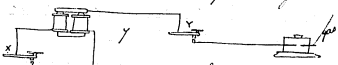
With an inch of Hard rubber in line we get sparks at intervals

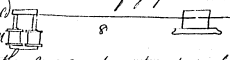
We then put a piece of glass in place of rubber & we got sparks at intervals

We put in a piece of glass that was bent as in 6 & we got sparks at intervals

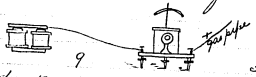


By closing x & working Y we could get no sparks when fixed as in fig 7. With the cores lengthened as in fig 8 & the cadmium placed on top of them & the magnet actuated by 3 cells of battery we could get sparks at times faintly.





We tried cores 6½ inches long in magnet shown in 8 & laid cadmium on top & got sparks just as brilliant as if on short cores



With mirror Galvanometer made of copper wire of 3000 ohms resistance, director very weak & near top scale 2½ feet off could not get the slightest movement, but by connecting one end of our graphite pencil box & x we got brilliant sparks inside.

With the cadmium bar stood up between the spools no result. With the cadmium bar placed across the spools in between cores no result.

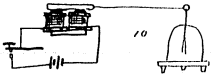
We put an Epinus condenser in circuit & get a splendid spark when both plates are in contact & weaker ones as they recede when both brass plates are six inches away from each other we get good sparks.

We placed the cadmium in local circuit & part of it with no result.

One of Ridder's Magneto Electric machines had both handles connected together & a wire taken from them to the pencils & got a good spark

When a six inch brass disc was placed on the poles of magnet & the cadmium laid on it that we get a good spark

When 30 inches of glass rod made part of line no sparks was visible



A Gold leaf electroscope that diverges its leaves 3 feet away from a common old fashioned plate glass machine gave no indications of 'Etheric force'

We tried to obtain Etherodes between which the spark will be more vivid than between graphite points. we fixed as in 11

x is a plate covered with tin foil.

Sesquioxide lead no good

Iodide lead more brilliant than on tin foil this would probably be good if hard pressed in to a pencil. We now discarded tin foil plate & used two lead pencil points thus

Sulphuret Antimony no spark

Spongy platinum spark in good.

Nitrate Calcium spark small.

Bone black pressed down with the finger in conjunction with the pencil point is better than the points alone. It seems probable that pencils of bone black pressed hard in a mould would be very delicate.

Benzoic acid no spark

Caustic Magnesia spark but no good

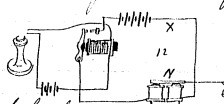
Lythargium no spark

Carbonate of lead no spark

Sesquioxide of iron no spark

Arsenate of Copper improvement on Carbon points makes longer spark

We now put on a self breaker thus:—



We found that if engine was connected in X circuit it either added resistance, or the spark of the break sets up a part for the self induction of the magnet N + prevents the generation of the Etherism.

Cast iron points between 2 carbon points give the best sparks yet.

Tar no sparks

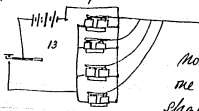
Ferrocyanide of iron no spark

Acetic Potash slight spark

We tried placing iron filings on a piece of paper over an electromagnet but the result was no better than if the magnet was not used.

Iron reduced by Hydrogen gives no spark hardly

Tried the Etherism from several magnets connected of for quantity thus:—



Spark not so good as when a single bar of cadmium is used. The magnets were not very even resistance. Took out one magnet which was fine when spark was not equal to single spool + cadmium. We tried middle power of our microscope + spark appeared about twice size. The glass lens or condenser at a certain focus makes the spark small but excedingly sharp + beautiful with various colors. We arranged 3 6 ohm magnets thus.

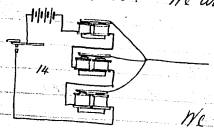


Fig 14 + the spark was better than with the 25 ohm magnet + Cadmium bar that we had been using all along.

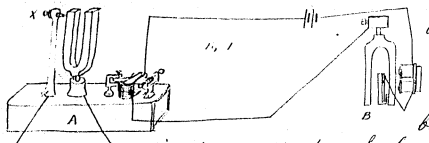
We now put in a single spool magnet of about 400 ohms + a cadmium bar on it + got a moderate spark, very irregular.

By connecting the top + bottom of core to line also improved it immensely. made it as good as 25 ohm spool + magnet.

Nov. 26th 1875. Chas Batchelor

43 Acoustic Telegraph.

We had two new tuning forks arranged thus. We tried A + B together but found we could not get A to respond although the vibrations came clearly on the magnet besides the rigid screw X upon the long upright dampened the fork badly.



We now had it altered thus: Fig 2 but still could not get them to work.

Disconnected magnet of B but kept contact broken in circuit with magnet A. By striking it we sometimes got a correspondence but not after. It then occurred that the fork of B made a double vibration, the prongs vibrating in the regular way, + the whole fork besides. the thin shank screwed into the wood support giving by the power of the magnet produced a false vibration + gave no results when held over a column of air of any length. To prevent this vibration the support should be metal, the whole apparatus mounted on metal + the poles of the electromagnet placed on both sides of the forks so as to balance this effect + give equal amplitude of vibration to both prongs. It is probable that the magnet grasps one prong + compels it to return before it has made the full swing, hence the other prong will not be in sympathy with it

It is also probable that as the movement of one prong is made defective the other should be made equally so to obtain proper results so we shall make magnets to have one pole on each prong of the fork

Nov 30th 1875 Chas Batchelor

(44) Etheric Force

We found the addition of battery to the Stable wire vibrator greatly increased the volume of sparks. Several persons could obtain sparks from the gas pipes at once each spark seeing equal in volume & brilliancy to the sparks drawn by a single person. If sparks are drawn off by a tonic held in one hand, the placing of the other hand on another part of the gas pipe will materially reduce the sparks

A very confusing & inexplainable experiment we had thus:- At the extreme end of a line of gas pipe at the other end of room brilliant sparks were drawn from the brass nut of the pointed burner, three feet from this burner was another which when grasped by another person standing on the dry floor reduced the volume of sparks drawn from the first burner to a point where they were imperceptible or nearly so, when the hand was taken off the sparks acquired its full brilliancy. Water was then poured to over the floor & a large piece of iron laid on it & connected to No 2 gas pipe by copper wire thus giving it a good route to it wds electricity. The sparks on No 1 Burner were undiminished in brilliancy. A person now grasped No 2 burner & stood on the wet part of the floor & instead of diminishing as before it did not affect it at all.

Several persons now grasped the pipes & Edison with a knife in one hand & a piece of wire in the other connected to the gas pipe obtained brilliant

sparks between knife & end of wire

A wire from the pipe was led to one of the iron pillars, to the stove & other metallic objects all of which showed brilliant sparks

Edison now grasped the pipe & with the other hand holding a piece of metal he touched several other metallic substances obtaining sparks showing that the force passed through his body.

Touching the Cadmium at intervals with a red hot iron gave no result

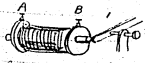
The spools were taken out of a Hidder magnet electric machine & the armature revolved at different speeds in front of the permanent magnet but without result.

Nov 30th 1875 Chas Batchelor

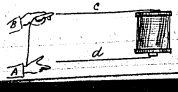
(45) Etheric Force.

Further experiments were tried to endeavour to prove that Etheric force was electricity of a certain degree of tension.

Smith from Chester's came over with a small induction coil & made the statement that it was induction. From x with 2 cells he could get no sparks (because that was not enough battery to get a spark between copper & copper). out of

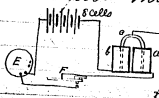


holding the hand near A or the outside of the coil the spark immediately appeared upon x. This was nothing more than induction as the sparks could be felt & seen jumping to the hand from the outside layers of the coil thence through body to other hand & so to x thence to top coil of primary to lower coil of secondary connected to B. This could be illustrated thus; the distance between d & c was too great to jump.



to jump but when the space was filled by a partial conductor the spark was obtained. The spark between A & B terminals of the secondary was ¼ on an inch. Mr Smith did not stop to witness the production of Etheric force under conditions which precluded induction. Mr Edison however gave him a diagram shewing how to obtain it from a sounder magnet with wire laid over the poles of magnet. At 8 PM we took our induction coil which gives ¼ spark & could produce same result as Smith (if) produce the spark from X by electrical induction, we then connected one end of secondary to the gas pipe leaving the other in air no spark could be obtained on pipes, we then connected the terminal in air with a piece of metal on the table & moistened it still no spark on pipes. Used 8 cells on primary. Mr Edison then left both terminals in air of secondary & connected X to Gas pipe & got good sparks. He then

connected A & B terminals of the secondary coil together still got spark but weakened as it should be part of the force going off in electricity though a small quantity of Great tension. I then disconnected the gas pipe wire from X & attached it to the secondary terminals which were fastened together could get no spark at all then from gas pipe. We now tried two 200 ohm spools thus:— a & b are the two spools con-



-nected with their two inside ends together, C is a thick copper rod bent in the form of a horseshoe & placed in the centre of each helix b & a but not touching either C is connected to our graphite points & to the gas pipe. E is a Bradley rheostat F a Key & everything thoroughly insulated. To prove the

insulation we connected the prime conductor of our plate glass machine to the Key F charging all the apparatus, upon disconnecting the prime conductor after ½ minute of time we got a spark from F notwithstanding the numerable points for the static electricity to dissipate from. We now received sparks on the graphite points with 1000 ohms resistance in the rheostat or from a strength of 1/100 of a bunsen cell on an internal resistance equal to itself. We now reversed the connection in the spools so as to make no magnetism (we used no iron) so to speak & we could the spark though the electric circuit had 2500 ohms resistance in it or 1/250 of a bunsen cell. We have noticed that when using an iron core & it is allowed to produce magnetism we get less etheric force & in proportion as we pull out the iron & insert the copper in its place we gain etheric force & if we connect the spools to give no magnetism we obtain the greatest etheric effect.

We took the copper horseshoe out & laid them

on the spools so that the ends just covered the holes in the spools & we could get the sparks when the electric circuit had 1000 ohms resistance. We now put in the vibrator used in our first experiments & increased the battery from 8 to 20 cells & connected X (see article 38 Fig 1) to gas pipe. Charley Edison hung to the gas pipe with feet above the floor & with a knife got a spark from the pipe he was hanging on. We now took the wire from vibrator in one hand & stood on a block of paraffine 18 inches square & 6 in thick, holding a knife in the other hand we drew sparks from the stove pipe. We now tried the crucial test of passing the etheric current through

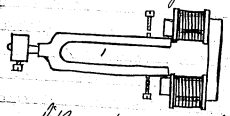
The sciatic nerve of a frog just killed. Previous to trying we tested its sensibility by putting the current from a single bunsen cell; we put in resistance up to 500 000 ohms & the twitching was still perceptible. We used the induced current from our induction coil having 1 cell on primary the spark jumping about 1/50 of an inch terminal of the secondary connected to the frog & it straightened out with violence. We arranged legs to pass etheric force through it; we placed legs on an inverted beaker & held the bare ends of the wires on the ends of glass rods 8 inches long; on connecting one to the sciatic nerve & the other to the fleshy part of the leg no movement could be discerned although brilliant sparks could be obtained when the frog was in circuit on the graphite points. Dr Beard was present when this was tried. The frog was now tested for delicacy with an electric circuit & although it had lost a little of its delicacy it was still exceedingly sensitive.

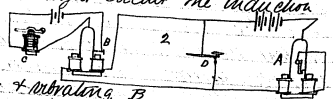
Dec 13th 1875

Chas Batchelor

(46) Acoustic Telegraphy

Coffin having transmitter & receiver made on this principle we found that we could not work them by direct contact so as Edison hit upon this plan which answered admirably & worked like a charm. With straight circuit the induction of sounder will not allow it to close



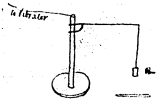


In this case vibrator A is always running & vibrating B when you press down key D it short circuits A & of course B stops & closes C sounder, which is quite the reverse of the sounder closing when you vibrate the fork. A very good idea.

Dec 3rd 1875

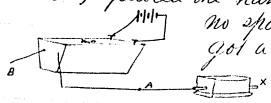
Chas Batchelor

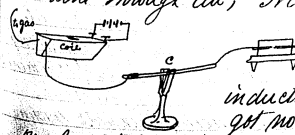
47 Etheric Force



Tried several different kinds of chemical crystals to ascertain if attracted or repelled by etherticity but with no result

Tried experiments with induction sparks to obtain scintillations & found that they were nothing like what they were from the etheric yet the spark jumped 1/4 of an inch. We tried an experiment with the large coil giving 1 inch spark connected thus one end of the secondary coil was connected to the graphite points & everything well insulated, placed one hand at B & touched X got no spark but on touching X we got a spark & strong shock on tongue; detached the hand from B but still kept tongue on X no spark; put the hand to X & got faint sparks; stood on insulated stool & got shocks, (put the wires on glass tubes 3 inches apart no spark touched the hand to the other wire & could draw sparks 1/4 of an inch long from it still no sparks could be drawn on the graphite points) connected a wire from A to gas pipe no spark, put the hand to X got a faint spark & shock on tongue, shewing it went through air, Tried this c to a glass rod





3 feet long 1/2 inch in diameter well warmed & wiped with silk; with induction current on full ~~we~~ got no spark, put the wires on glass tube 3 inches apart. no spark.

touched the hand to the wire on left & could draw sparks ⅛ of an inch long from it still no sparks. Stood on insulating stool with hand on wire to left felt strong shock, no sparks, made the hand approach within 8 inches of the wire on left got sparks tried it a number of times the approach of the hand rendering sparks visible. This proves quite conclusively that the Etheric force that cannot jump through space will travel through a length of glass many times greater than a high tension spark jumping ⅛ of an inch

We tried the following substances made into solution & paper wetted with them to see if we could get the force to mark on any.

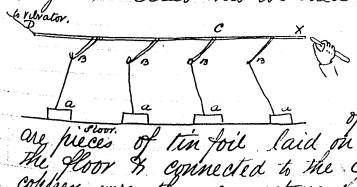
Caustic Magnesia & Silicate of Soda no mark
Oxalate of Cerium " "
Citrate of Potash
Carbonic Acid & Silicate of Soda
Ferrocyanide of Potassium
Sulphate of Manganese
Bichloride of Mercury & Sil of Soda
Phosphate of Soda
Lycopodium
Nitrate of Berberin, Acetate of Lime
Sulph carbolate of Soda, Sulphate of Morphia
Bichromate of Ammonia, Sulphurate of Copper
Tartrate of Ammonia, Iodine resublimed
Bicarbonate of Potash, By Iodide of Mercury
Chromate of Potash, Camphor.
Carbonate of Copper, Arsenate of Manganese
Carbonate of Ammonia, Sodium hyposulphite
Chloride of Nickel, Bisulphate of Potash
Thymol, Iodide of Sulphur, Antimonic Acid
Sulphur, Protochloride of Iron, Iodide of Antimony
Morphine, Acetate of Morphine, Sulphate of Ammonia
Iodide of Silver, Brucine, Citrate of Quinine,
Cyanide of Silver, Tetanic acid, Tannate Quinine
Asparagin, Sulphate of Caffine.

Hypophosphate Quinine, Lactophosphate of Bismuth
Lactate of Bismuth, Urea, Bromide of Silver,
Sulphate of Nickel, Muriate of Quinine,
Sulphuret of tin.

Dec 3rd 1875. Chas Batchelor

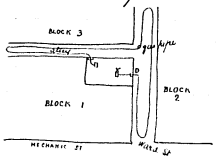
48 Etheric Force

Tried the following experiment upon a galvanoscopic frog: This frog gave contractions with one cell of Bunsen battery through one water rheostat about ten inches long; & when connected with the vibrator feebly contracted the frogs leg though not at all in proportion to the sparks got under the same conditions. Tried it several ways & got the contractions from the supposed Etheric current. Thinking that it might be due to the creeping of the induction current from the legs of the battery stands which were wet in some places we wiped them dry, but got it again with the same force. This would seem to be one proof that it is electricity, although not conclusive as the insulation of the battery was not excellent & the weather was damp having rained all night. Also this we tried:—

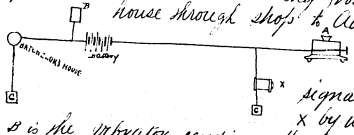


D goes to vibrator & battery, C the several gas jets in different parts of the room, a, a, a, are pieces of tin foil laid on a wet spot on the floor & connected to the gas jets by a copper wire thus connecting without resistance all the gas jets with the floor, at the furthest end from the vibrator the sparks could be drawn

off apparently of undiminished brilliancy.
Another experiment was tried:—



X is the vibrator on the operating table in laboratory thoroughly insulated as also the battery to the end of the vibrator was attached a small uninsulated copper wire 23 yards. This wire was taken out of the door D in the wet sheet (raining all night) & laid in the gutter to Mechanic St back to shop, up the alley & back in at the side door & up into the room above the laboratory & connected there with the carbon point, the other point being in contact with the gaspipe. We got the spark all right. This wire was also wound the lamp post in the street. The carbon point being disconnected from the gaspipe the spark was got at intervals.
This experiment was tried thus upon our private telegraph line, a short wire running from Batchelors house through shops to Adams house.



Batchelor could transmit signals to the relay X by working his key. B is the vibrator sending etheric currents to Adams house. A is the box with gaspipe points. Notwithstanding that Batchelor was transmitting signals to Adams in the ordinary manner the etheric currents were plain & not interrupted by the morse signal.
We connected vibrator with the speaking tube & got the sparks in the 4th floor off the staples that held the tube although we could not discern any from the tube itself we were standing on hard rubber.

Dec 4th 1875.

Chas Batchelor

49 Etheric Force.

We put up 16 cells Bunsen & using a Phelps as a vibrating sounder, insulated both battery & sounder on glass bottles 7 inches high, wiped perfectly with warm handkerchiefs. The spark was exceedingly strong from the vibrating lever. A file suspended from a silk floss fibre (Fig. 1) having a length of about 2 feet was allowed to touch the metallic part of sounder & brilliant sparks were obtained. Three persons grasping hands & standing upon sheets of paraffine 12 inches square & 1/2 inch thick drew sparks from the adjoining stove, when another person touched the sounder with any piece of metal. The three standing on floor gave same result, but it did not probable the spark was weakened to a point where it was difficult to see especially as the pipe was rusty.
The galvanoscopic frog giving contractions with one cell through his water rheostat was then placed in circuit when the wires from the vibrator & gas pipe were connected slight contractions were noticed sometimes very faint & marked shewing the apparent presence of electricity which from the high insulation seemed improbable. Dr Beard who was present inferred from the way the legs contracted that it moved on both opening & closing the circuit & test this we disconnected the wire between the frog & battery & placed instead of a vibrating sounder, a simple morse key & a sounder taking the etheric from armature. The spark was now tested in the box & found to be very strong it was then connected to the nerves of the frog but no movement of any kind upon working the key could be detected although the brilliancy & power of the spark was undiminished. The thought then occurred to Edison that the movement of the frog was due to mechanical

vibrations from the vibrator, (which gives probably 250 vibrations per second) passing through the wires irritate the sensitive nerves of the frog. Upon disconnecting the battery wires & holding a tuning fork giving 336 vibrations per second, to the base of the sounder the vibrations over the wire made the frog contract nearly every time & as the sounder is somewhat different from a perfect tuning fork inasmuch that it probably transmits some longitudinal vibrations which are infinitely more irritable than ordinary ones, even to a human being. The contractions of the frogs legs may with considerable satisfy be said to be caused by these mechanical vibrations being transmitted through the conducting wires.

Dec 5th 1875

Chas Batchelor

Longitudinal Vibrations

We took a long iron wire 1/16 of an inch in diameter & rubbed it length wise with a piece of leather with resin on it for about 3 feet backwards & forwards; about ten feet away we applied the wire to the back of the neck & it gives a horrible sensation showing the vibration conducted through the wire. Mr Edison thinks there is great probability that certain tuning forks will set certain nerves in the body vibrating in unison with them & with proper means & different forks, singly or combined, all the effects upon the muscles or nerves produced by induction currents can be produced by forks.

Dec 5 1875.

Chas Batchelor

Galvanoscopic Frog.

A frog prepared at 2 a.m. & allowed to become quite dry & stiff upon wetting was exceedingly sensitive at 5 30 AM being 3½ hours.

Dec 5 1875

Chas Batchelor

Acoustic Telegraphy

We found that the amplitude of the vibration of the large 6" forks was practically insufficient to work the sounder. The fusion of the points at so close an adjustment being one of the objections. We moved the spring contact on the self acting fork nearer hoping that the pressure dampened the fork & threw it out of unison, but found that placing the contact here where the swing was less was not a success although it appeared to give the fork a better tone. I made the receiving fork very weak owing to the lightness of the transmitted waves, attempting to lengthen them made the play of the spring in transmitter so close that it stuck & sent bad waves.

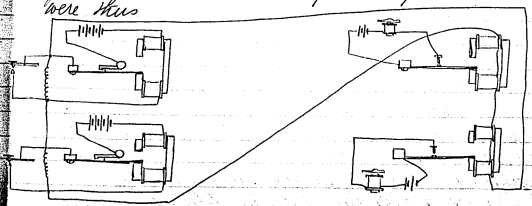
We concluded to make thinner forks & whilst they are making Batchelor arranges thin reeds as temporary devices till the forks are completed.

Dec 6th 1875.

Chas Batchelor

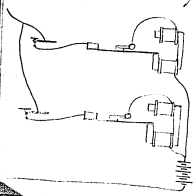
Acoustic Telegraphy.

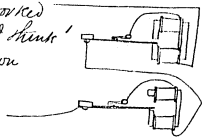
Tried the four reed vibrators & had them so adjusted that by sending one set of vibrations its corresponding reed gave an amplitude of ¼ of an inch while the other scarcely moved & by sending the other set of vibrations the other fork did the same, but when both came together it was mixed up badly. The connections were thus



We also found that every time we altered the self make & break spring on the transmitting reed it altered the receiving reed, throwing it out so much sometimes that we were compelled to lengthen or shorten it of an inch. At one time we received separate signals quite readable but there was no margin & the means of adjustment were entirely inadequate. Tried putting in a WU Relay & receiving vibrations on that. It is probable that Helmholtz's resonators would pick out the signals. We tried the following connections but they did not work well.

We also tried Fig 2 & it worked fair but not so good I think as the method first shown





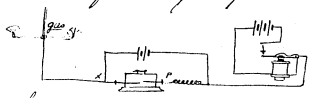
Dec-9th 1870 Chas Batchelor

(54.) Etheric Force

Tried several experiments to telegraph over the wire running from the Laboratory to A & P Yd Off 140 Broadway N.Y. This wire crosses into N Y at 63rd & is 26 miles long passes through 3 cables. In W.U. sounder vibrating with 12 cells of battery, the wire running to New York & New York connecting the wire direct to the pencil & from the other pencil to the earth no spark was received. The earth wire was then put on at Newark, nothing. New Brunswick end of wire was then put on, nothing. Several changes were made but no spark received. So we have ascertained that all telegraphic apparatus makes this spark & that one generator connected to one

end of the box & another to the other end, we obtain about double the intensity. The addition of a third however on one end decreases the spark & on the other end increases it. It is reasonable to suppose that the spark might be neutralized by other generators being connected to the main ground wire in New York office. After Johnson & Adams returned from N.Y. we connected a wire from one of the acoustic telegraph insts: & run it out of doors (weather cold & ground frozen) but did not succeed in obtaining the spark more than 25 feet away from the door. When however the acoustic vibrator was in we got it clear round the block about 1200 feet. The sparks only occurred at intervals, & we used bare No 23 wire.

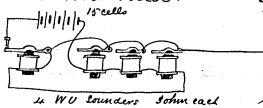
The following experiment was tried:-



The spark passed through box undiminished.

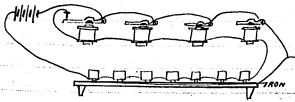
We also tried connecting the wire from battery at X instead of X but no change in spark.

We now tried:-



Sparks exceedingly brilliant shewing that the amount was increased greatly. We then tried this:- the box X was detached & a wire 3 inches long left fastened on to the pencil almost continuous sparks could be obtained when this was held within 3 feet from the sounders.

We now tried:-



The addition of three exha magnets placed on a bar of iron reduced the strength of the spark

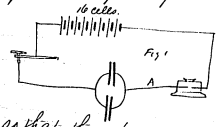
The total resultance is what in all probability brought it about. The iron bar was laid on bearable alas on hard rubber. The magnets were first laid on bare iron afterwards paper was placed between the core & iron. Dr Beard was present.

Dec 9th 1875

Chas Batchelor

55 Ether force

Dr Edward, president of a scientific association in Newark was present & stated that the phenomenon was far from a new force that there was not any more new forces. The sparks were simply due to inductive electricity of low tension. Notwithstanding that the spark could be obtained through glass a greater distance with ethric than with a jump spark from an induction coil or from a plate glass machine. He could give no idea how to prove it. The following experiments were undertaken to prove if possible Mr Edwards assertions. Two condensers of about 250 microfarads capacity each were connected thus:—

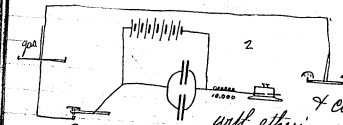


We obtained the spark as was to be expected

We now put in 10000 ohms at A & still obtained the spark.

We then opened the coil A so that the spark could go across the insulation

No spark on trembling the key. We then connected it thus

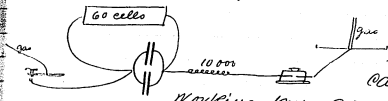


Got the spark through 10000 ohms but when it was opened no spark. The opening & closing of the circuit with ethric makes no difference.

Again a glass rod was used at A Fig 1 with wires ¼ of an inch apart no spark while ethric gives it through 3 feet with only 1 rounder vibrating.

Even induction coil current jumping ½ inch did not give it or plate glass machine

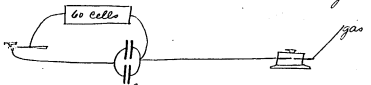
Another experiment was tried with low tension inductive electricity thus:—



The battery of 60 cells gave powerful electric light with carbons ½ inch apart.

Working key gave faint red sparks between pencil points as large amount of battery electricity passed through besides the static. The snap was much louder from the condensers than from a Leyden jar throwing ½ inch spark. This did not jump the air only gave spark on contact. When the resistance coil of 10000 ohms was opened got no spark by the most careful adjustment

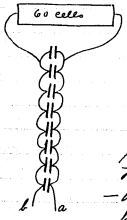
Connected it thus:— but got nothing.



Dec 11th 1875 Chas Batchelor

56 Condensers

We connected 8 condensers having an aggregate capacity of 22 Microfarads to our 60 cell battery in the following manner.—



By putting a & b together the most brilliant spark that I ever saw was given off. The scintillation went out from the contact points at least 3 or 4 inches. Thousands radiating from the centre like the rays of the sun each scintillation ended in a fork like a hen's foot, the snap was like the crack of a cap yet with all this power on

sparks were seen on the graphite points.
Dec 11. 1875

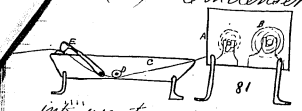
Chas Batchelor

57 Electric Light

Thirty one cells of 1½ Carbon battery was put up connected to an apparatus with Carbon points it was very brilliant & sufficient for lecture purposes. We found that when Sodium, Potassium or Iodide of Cadmium was used the light could be drawn out much longer & was more brilliant
Dec 11. 1875

Chas Batchelor.

(58) Condensers



Our apparatus made for making condensers some nine months ago have just been brought into use to make our condensers & we find the principle to be first rate. It is this. We first cut the paper into the requisite width & roll it on to small rollers to go into the oven. The small rolls are then placed in the oven & baked at 150° Fah. to get the water out of it. A large dish containing paraffin kept at 220° just hot enough for the water to pass off as steam & not boil the paraffin is kept in front of the oven. The paper is unrolled from the oven & passed under the roller D in paraffin & then under the stripper E which takes off all the superfluous paraffin & then drawn off in lengths of 20 feet & held a few seconds to dry perfectly it is then let down on a board which is marked to the length of sheet & cut.
Dec 25.

Chas Batchelor.

59 Etheric Force.

An Experiment tried tonight gives a curious result A is a vibrator B C D E are

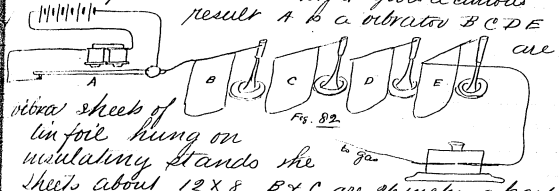


Fig. 82.

vibra sheets of tin foile hung on insulating stands the sheets about 12 X 8 B & C are 26 inches apart C & D 45 inches, & D & E 26 inches, B is connected to the vibrator & E is connected to point in box. the other point to ground. We received sparks at intervals although insulated by such space.
Dec 26

Chas Batchelor

60 Acoustic Telegraphy.

Worked 3 messages in the same direction on this principle each key

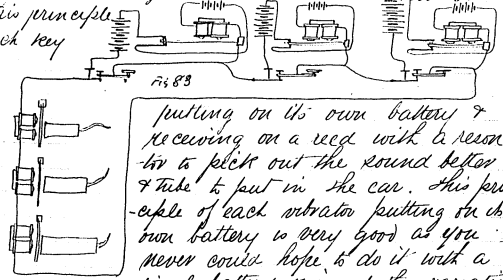


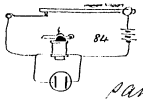
Fig. 83

putting on its own battery & receiving on a reed with a resonator to pick out the sound better & tube to put in the ear. This principle of each vibrator putting on its own battery is very good as you never could hope to do it with a single battery owing to the variation of the reeds when there are different numbers of magnets on.
Dec 26 1875

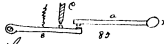
Chas Batchelor

(61) Acoustic Telegraphy

We found a means of receiving on a sounder off a reed by the following means. Fig 84 shows it. It is by putting a secondary battery or solid water shunt round the sounder. This secondary battery sends a current in the same direction on opening the electrical circuit. The vibrator strikes its contact point so rapidly that without shunt the induction from magnet would not allow the lever to come down but when the shunt is on its current operating in the same direction tends to hold it down. It seems strange that when you put 6 cells on to a local like this it will not respond but when you shunt ½ or ¼ of the current it works perfectly.



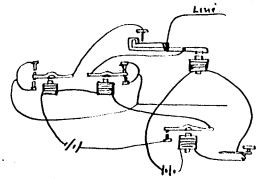
We have also found that it is necessary to have a contact on ~~transmitters~~ receivers like 85



a is a vibrator, b is the contact which is solid & rests against the contact screw c when the right note comes the lever drives the contact lever away from screw.

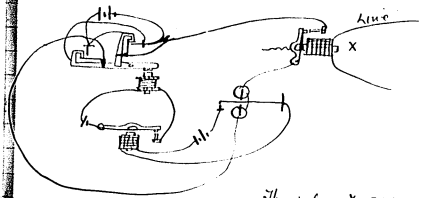
January 7th 1876.

Chas Batchelor

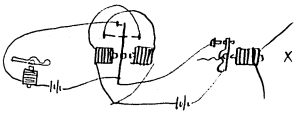


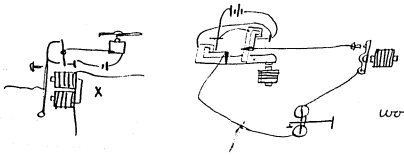
Doubler

In making both the back and front strokes on the down causes the operator to very easily get the "backstroke" & obviate this by transmitting a long opening of the circuit for closing and a short for opening. This causes the sounder at the receiving end to give a different sound on closing than on opening. The following are various devices for commuting two slight openings of a relay into regular dots and dashes on a sounder

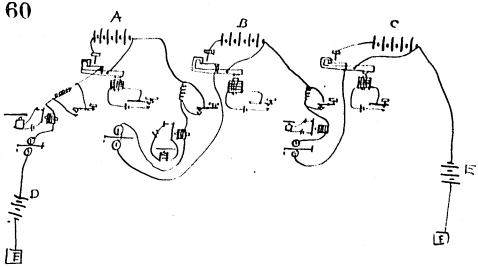


The relay X may work a back pouch on sounder and the sounder work the polarized relay.





works very well



Doubler by reversals, and increase and decrease batteries A.B.C are at way stations and have twice the strength as both D & E combined so that when D & E are on the line alone the current is say 100 in one direction but if either A B or C be inserted the current of D E is neutralized and 100 flows in the opposite direction.

Duplicating Press.

In printing copies when you want to take a number, if you put a very thin coat of shellac and alcohol on the stencil that it will not require much rubbing and an excess of ink does not blur the copy. The roller feels as if it was rollering a sheet of glass and makes a good copy.

If you oil the stencil shed a little bear working you can also take the first copy very quick.

The best paper for stencils for our No 1-2 presses we have found to be Grannis parchment paper No 10 very thin but almighty tough

For making large stencils for maps & plans a parchment paper must be used which should be wet & press frame & dry when dry it will be as tight as a drum. The stencil should not be made until it is dry and in using it will not make double lines by the paper running

Oct 1st 1896

Chas T Batchelor

Electric Light May 26. 1877

Notes

Liebig & Kopp Rept vol 1

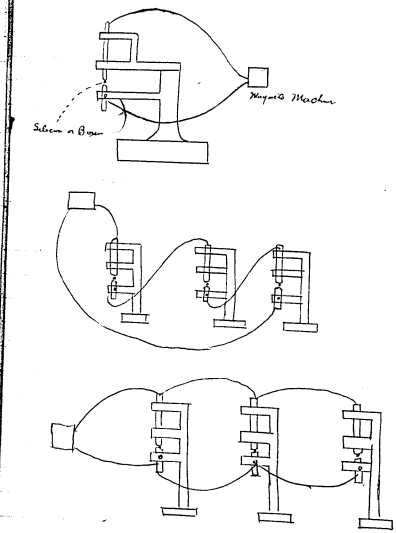
P 114 describes train gearing for velocing in oil large sectional area tube underlower note 117. P

Bellani deduces observation of Galton that lightly stretched brass wires in free air sound only during change of weather no sound obtained in either fine rainy or very windy weather.

This appears to belong to some other experiment not Electric light. for Electric Light see next Page

W. C

Electric Light Sept 9. 1877.



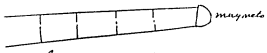
The employment of Silicon or Boron = (metalic arms to move the continuity by their conductivity and Satile have resistance enough to allow the arc to form. besides the pressure of silicon keeps the carbon points at a proper distance by its pressure between them

Copied from Original drawing page 1. this 28th day of September 1878

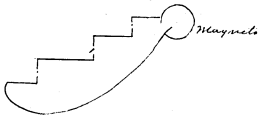
Wm Carman

Electric Light Nov 1. 1877

I have tried Boron Ruthenium Rhodium and the almost infusible metals for operations in my electric light device = Boron is very High resistance and would do if arranged thus



Silicon on the other hand is very low resistance and would have to be arranged thus



I think powdered Silicon mixed with lime or other very infusible non conductor or semi conductors would be good as

Copied from original drawings page 2. this 28th day of September 1878

Wm Carman

Electric Light Dec 8. 1877

Further experiments with Ruthenium and Selenium prove their adaptability to substances of the light —
It was possible to get good results by powdering this selenium and putting it in a glass tube passing the current through the powder

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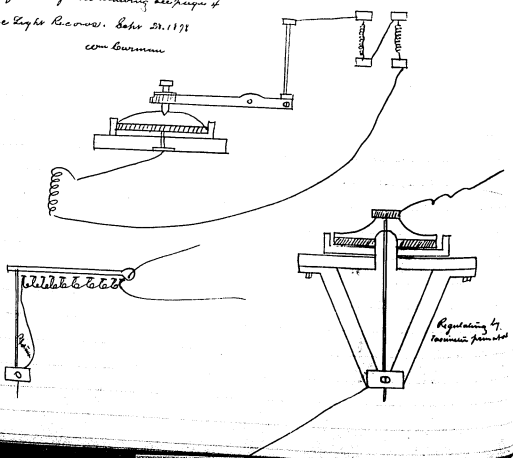
Copied from sheet No 3 Electric light original drawing this 28th day of Sept 1878

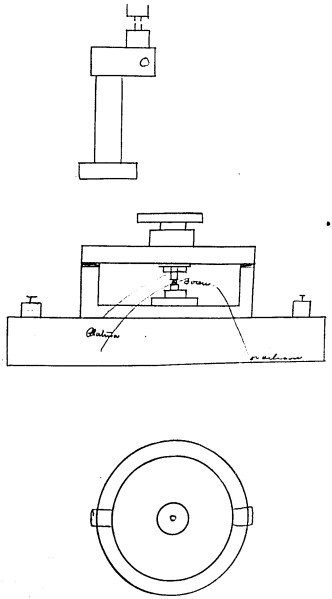
Wm. Carman

Electric Light April 14. 1878

Copied from original drawing see page 4
Electric Light Records. Sept 29. 1878
Wm Carman

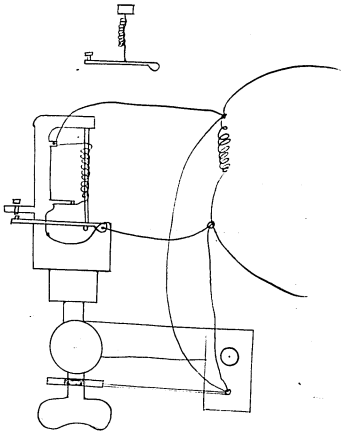


Electric Light Aug 27. 1878



Copied from page 5 of Electric Light records Sheet 28 Day of Sept. 1878
Wm Carman

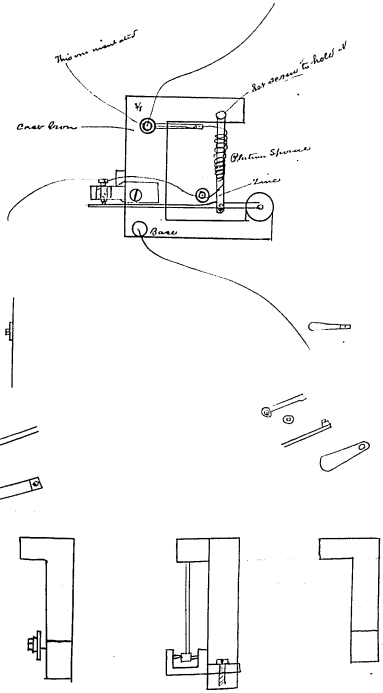
Electric Light Sept 10. 1878



Copied from page 6 of Electric Light record this 28 day of Sept 1878

Wm Barman

Electric Light Sept 10. 1878

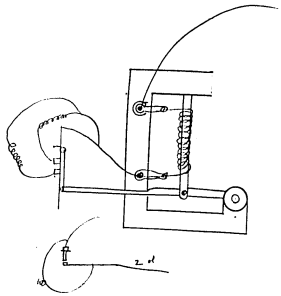


Copied from page 7 of Electric Light record this 28 day of Sept 1878

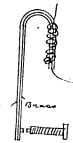
Wm Barman

Electric Light Sept 11. 1878

Subdivision

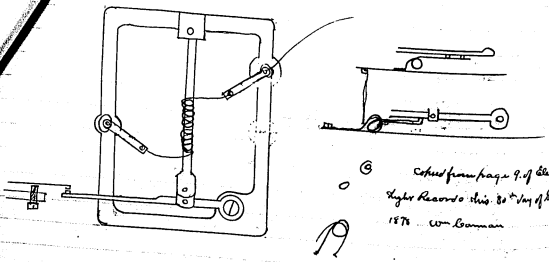


To prevent flickering fast in resistance so by bellcrank on end of lever



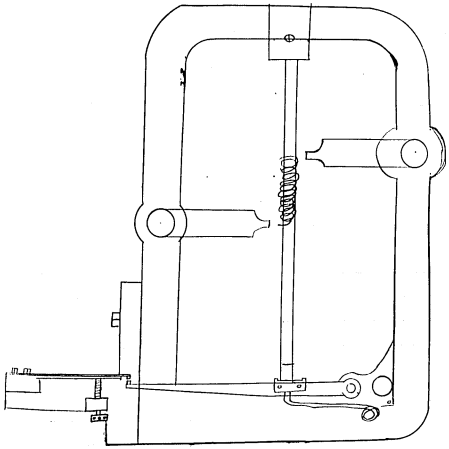
Thin strip of Brass and Iron together and bent up in a U shape. These are very sensitive

Copied from Electric Light record of Sept 11. 1878 Page 8 this 30th day of Sept 1878. Wm Barman



Copied from page 9 of Electric Light Record this 30th day of Sept 1878 Wm Barman

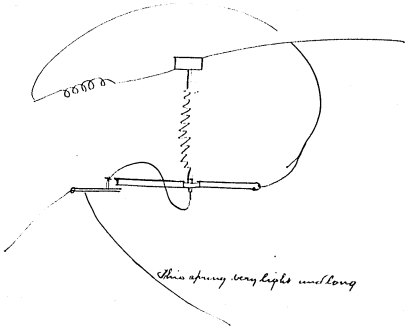
Electric Light Subdivision Sept 12. 1878



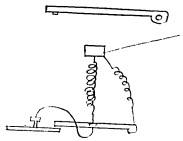
Copied from page 10. Elec Light Record this 30th day September 1878

Wm Barman

Electric Light. Subdivision Sept 12. 1878

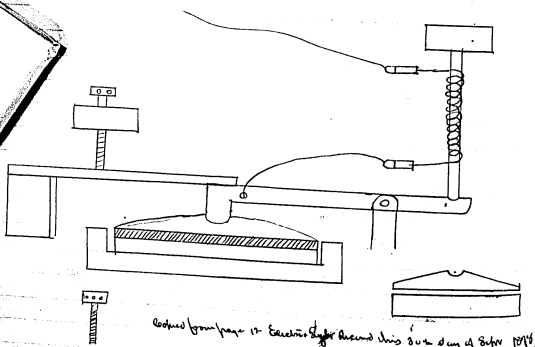


This spring very light and long



Copied from page 11 E. Light record this 30th day of September 1878

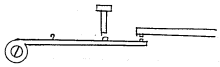
Wm Carman



Copied from page 12 Electric Light Record this 30th day of Sept 1878.

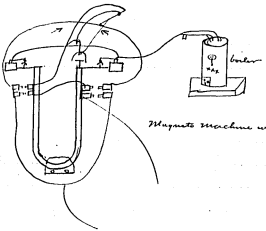
Wm Carman

Electric Light Subdivision Sept 14. 1878

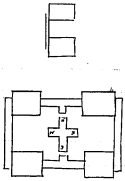


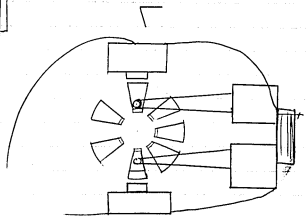
Copied from page 13 Elec Light Records this 30th day of Sept 1878 Wm Carman

Magneto Machines Sept 14. 1878



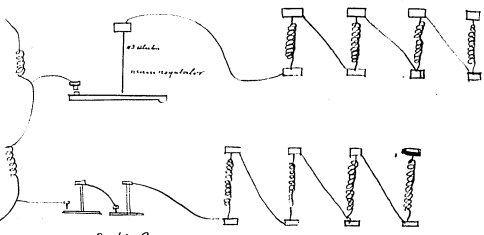
Magneto machine with fork

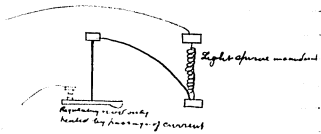


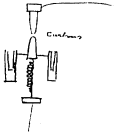


Copied from page 14 E. Light records this 30 day of Sept 1878. W Carman

Electric Light Sept 11. 1878

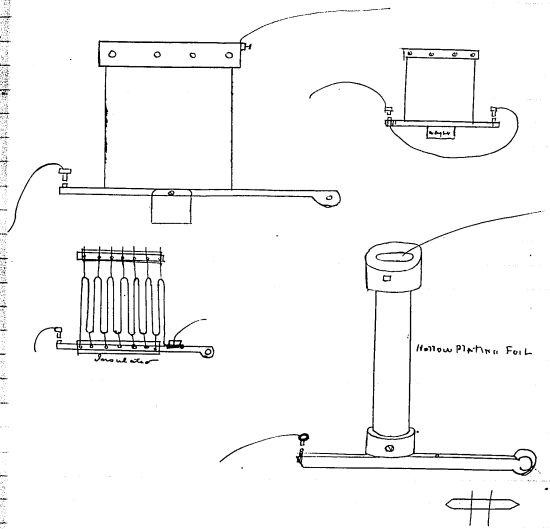






Copied from page 15 Elec Light Record
this 8th day of Sept 1878. Wm Bannan

Electric Light Sept 11. 1878

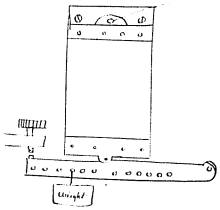


Copied from page 16. Elec Light record this
30th day of Sept 1878. Wm Bannan

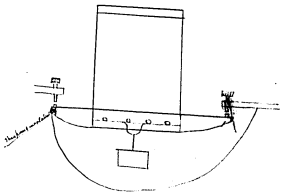
Electric Light Subdivision Sept 15. 1878

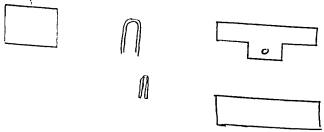
Knowse

Make "light" instrument like this



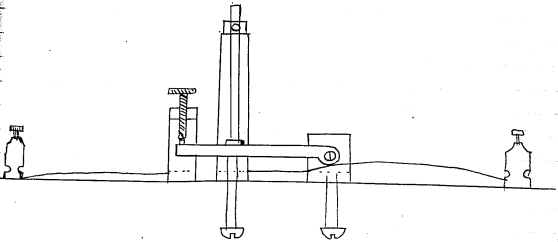
and another with double points

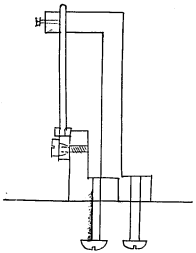




Copied from page 117 Elect Light Records Sept 20. 1878 . Wm Carman

Electric Light. Sept 16. 1878

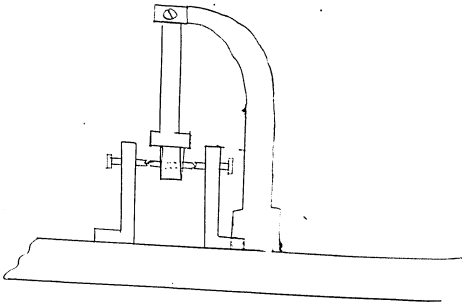


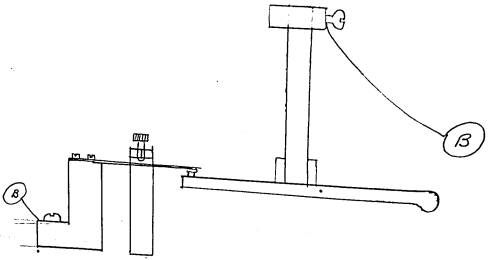


Copied from page 18 Elec Light Records this 30th Day of Sept 1878

Wm Carman

Electric Light Sept 17. 1878

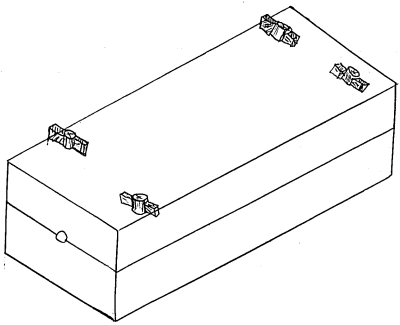


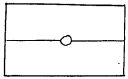


Copied from page 19. Elec Light records this first day of October 1878. Wm Barnum

Electric Light. Subdivision Sept 17. 1878

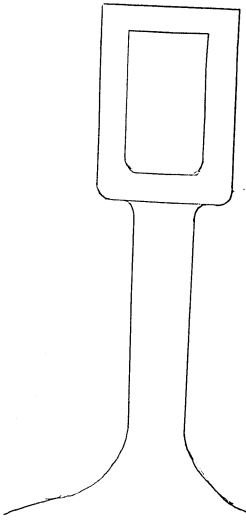
mould for composition for increasing the heat in spiral in a glass tube





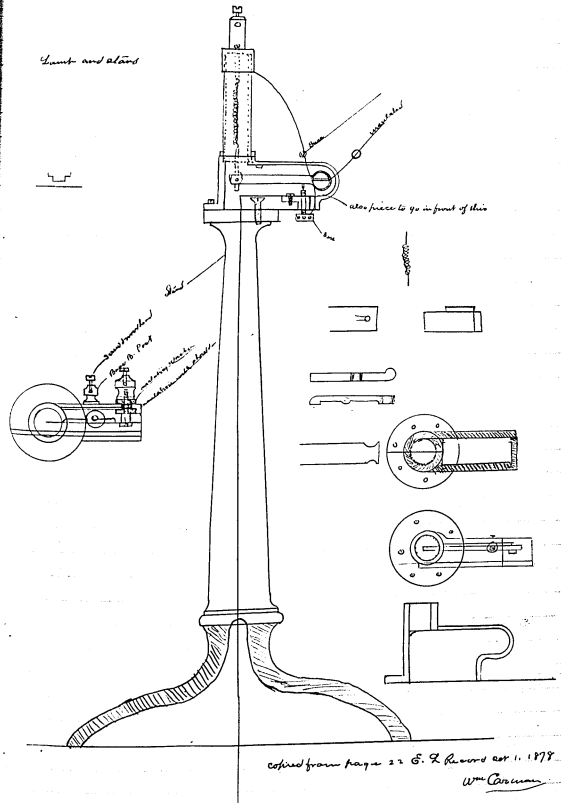
Copied from page 20 Electric Light Record this first day of Oct 1878. Wm Barnum

Electric Light Sept 17, 1878



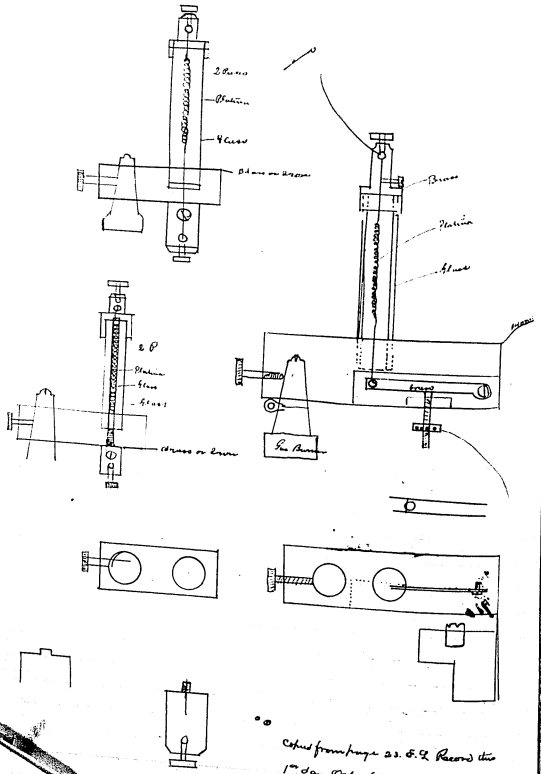
Copied from page 21 Electric Light Record
this first day of Oct 1878 . Wm Carman

Electric Light Subdivision Sept 17, 1878



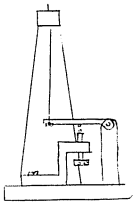
copied from page 22 E. L. Record Oct 1. 1878
Wm Carman

Electric Light Sept 17. 1878



Copied from page 23. E.L. Records this 1st day Oct 1878 W. Carman

Electric Light Sept 17 1878.



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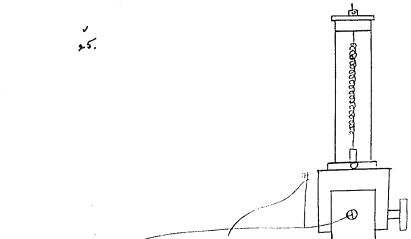
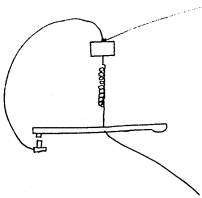


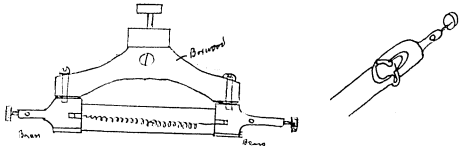
Copied from page 24 Elec Light Records this 1st day of Oct 1878
W Carman

Electric Light Sept 17. 1878



Copied from page 25. E.L. Records this 1st day Oct. 1878. Wm Carman

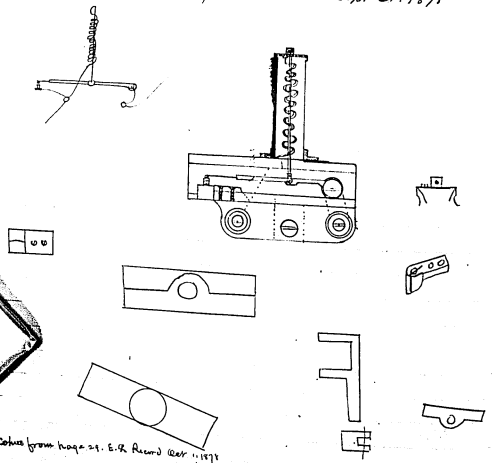
Electric Light Sept 18. 1878



Kruger makes one this way, with ear holes in the end

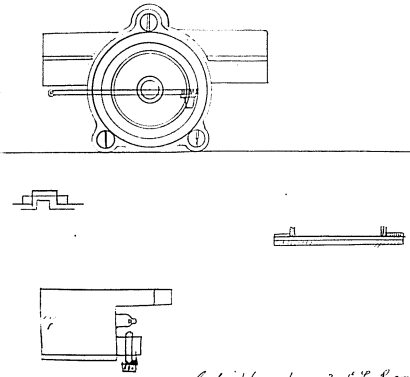
Copied from page 34 Elec Light Record this 1st Oct 1878 Wm Cannon

Electric Light Subdivision Sept 21. 1878



Copied from page 29. E.L. Record Oct 1. 1878
W Cannon

Electric Light Sept 23. 1878

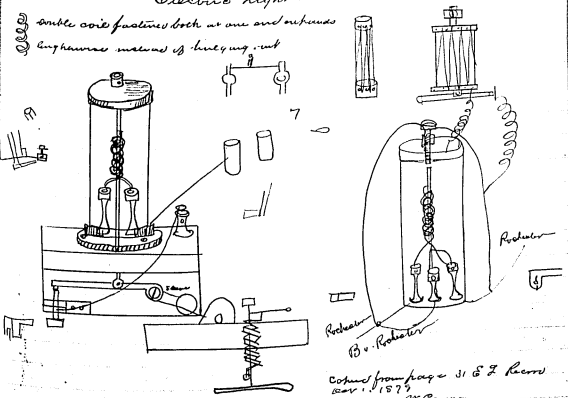


Copied from page 30 E.L. Record Oct 1. 1878
W Cannon

Electric Light Subdivision Sept 28. 1878

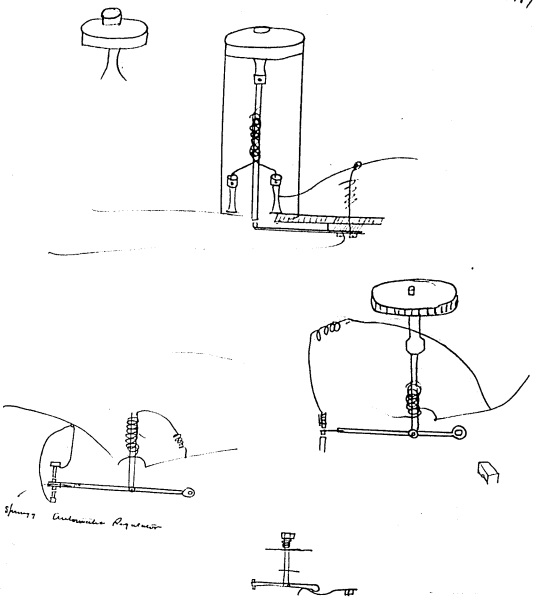
Double coil fastener both at one end and upwards

Engineers material of tinkering cut



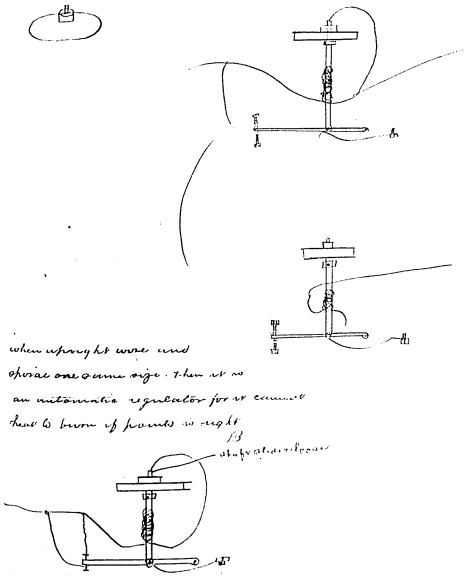
Copied from page 31 E.L. Record
Oct 1. 1878
W Cannon

Electric Light Division Sept 24, 1878

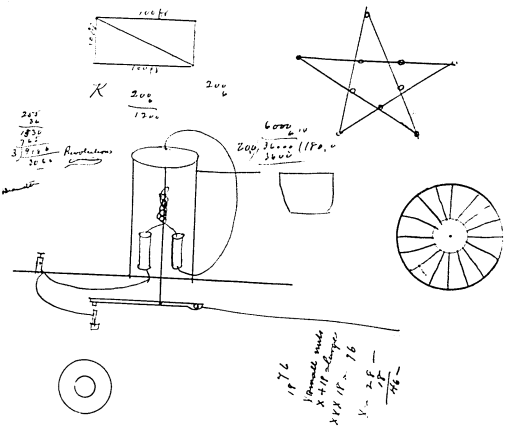


Copied from page 32 E & L record Oct 1, 1878
Wm Carman

Edisons Electric Light Subdivision
Sept 24, 1878



Copied from page 33 Elec L Record Oct 1, 1878
W Carman

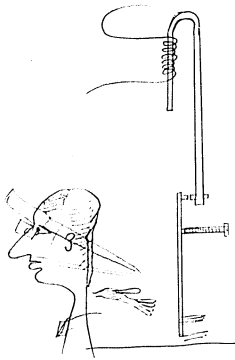


Two boys had 36 apples together & one had 18 more than the other how many had each

~~3 women went~~ 2 - 9 7 9 / 58 29 / 18 / 47

Copied from page 34 E. L. Oct 1. 1878
Wm Carman

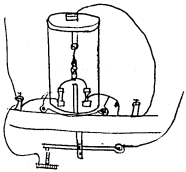
Electric Light Sept 25. 1878



Copied from page 35 E. L. Record
Oct 1. 1878 Wm Carman

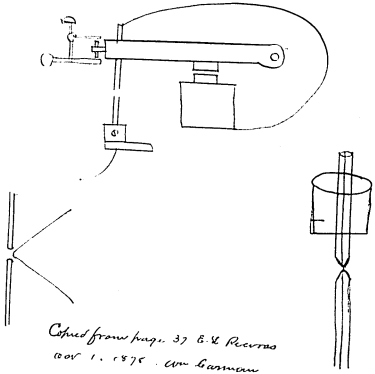
Electric Light Division Sept 25. 1878

we now have a perfectly regulating light spiral wound double to allow for expansion. and the wire in middle same wire as the spiral only the spiral is flattened to make stronger and allow more heating surface as the Platina rod expands or closes the cut off points at x and when the spiral and Platina ~~rod~~ are the right size. this is a perfectly automatic cut off; so that however much current you put on it will regulate before burning up although the contraction when cold has allowed the points to separate 1/8 inch



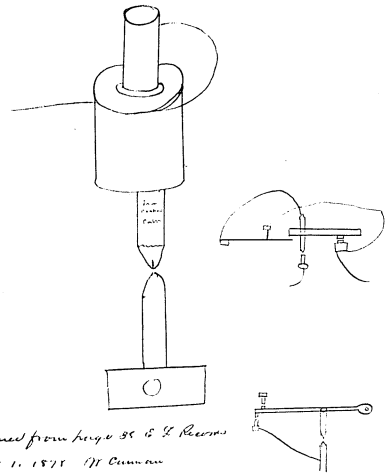
Copied from page 36 E. L. Records Oct 1. 78
Wm Carman

Electric Light Sept 25. 1878



Copied from page 37 E. & Record
Oct 1. 1878. Wm Cannon

Electric Light Sept 25. 1878



Copied from page 38 E. & Record
Oct 1. 1878 Wm Cannon

Electric Light Subdivision Sept 26, 1878

Last night we placed wound our light another glass tube & cemented it at bottom and filled the intervening space with alum and water. to prevent in a measure the radiation of heat from it. This has the desired effect to a great extent but we want something that will do it better

Copied from E. & record page 37
Oct 1. 1878. Wm Cannon

Electric Light Division Sept. 26. 1878

Experimented with incandescence of sticks of Carbon - it will expand and cut off similar to Platina or other metals but when brought up to give the same light as platina it melts very easy

---

I put sticks of different thickness and lengths of Carbon in place of platina in our light stand result was not comparable with Platina

---

we want Osmium or platinum - Iridium also buy Ruthenium

Sticks of finely divided platinum —

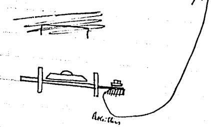
Copied from page 40 E L Records Oct 2. 1878

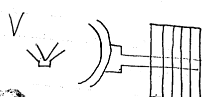
Wm Carman

Sept 27. 1878

Kruesi

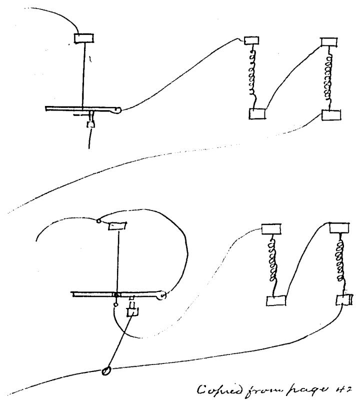
Will you fix this platina to the glass. and cut away the brass right under the tag X and make the tag on it narrower so as to make the platina have no pull on it whatever





Copied from page 41 E L Record Oct 2. 1878 Wm Carman

Electric Light Sept 27. 1878



Copied from page 42 E L Record Oct 2. 1878

W Carman

Electric Light Sept 20. 1878

40 ft per foot - 211 200 ft per mile

46 .. per foot 243.480

1760 528000
3 x 80 211200

2029 yds
6087
243480

243480) 11.920000 (.00489

.00489 ohms
243480

.00489 ohms

.00978

12000 ft copper 40 ft per foot

.009780 ohms

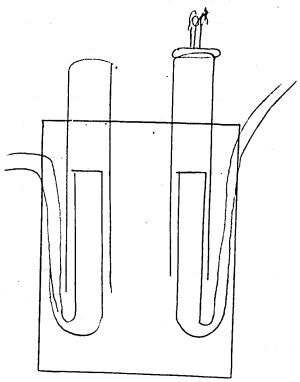
8 5/8

1.00000

Copied from page 43 Elec L Record Oct 2. 78

Wm Carman

Electric Light Sept 27: 1878



Copied from page 44 E. L. Record Oct 2. 1878.

Wm Carman

Electlight Sept 27. 1878

8
9
8760
22
12
4

64
2
42
1
1024

50.2656
12
602 1872

Solid contents in inches

321.18
5.06
1221.6
1605.90
1618.14

32 118
608
96 354
192 708
193 671 0

5 280) 113 400 (21 1/4
10560
7 800
5 280
25 20

32
12
48

128

2 13/16

113 400

21 1/4
9
189

6 13
84

Copied from page 45. E. L. Record
Oct 1. 1878 Wm Carman

Electric Light Subdivision Sept 27. 1878

Length of time it takes to heat after Bunsen Burner to red heat the following substances

	Seconds	Remarks
Limes for O.H. Light	2	
Kaolin	1 1/2	
Tripoli	1	
Sulph. Baryta	3	
Whiting	5	
Fire clay	3	
Silicic Acid	7	
Woodbridge Clay	4	takes 7 to heat first time
Coral marble	5	
Pumice stone	5 1/2	
Platinum Black		first crate heats before Platinum
Caustic Magnesia		heats white when platina red
Carb Magnesia		" " " "
Caustic Magnesia		contracts less by heat than Carb Mag
Oxalate Cerium		Excellent good gets red before platina spoon

Copied from page 46 E. L. Record Oct 2. 1878

W Carman

Electric Light Subdivision Sept 27. 1878

made cylinder of burnt magnesia pressed for light and it retains its heat but the loose unpressed does it much better

Struck the idea that probably coating the Platina spiral with a saturated solution would be what we want

Solution Alum	very good bright and leaves good deposit on spirals
Tungstate Soda	no good
Chlo Potash	no good
Chloride Sodium	very good, small deposit
Acetate Lead	no good melts Platina
Sulphate Thallium	no good
Carb Lithia	fair something like oxalate lithium

Copied from page 47 E L Record
Oct 2. 1878 Wm Carman

Electric Light Sept 27. 1878

Oxide Zircon	not very good might try it further
Niobic Acid	fair reduch
Wolfram	not good
Cocaum Alum	not quite so good as magnesia
Osmium	N. G
Strontium	N G
Protochloride tin	N G
Lactate Zinc	fair
Carbic Strontia	N G
Brom of Cadmium	N G
Carb Lithia	N G
Oxide Glucinum	acts like magnesia
Ox Beryllium	not good
Acetate Aluminas	N G

Copied from page C L Record Page 48
Oct 2. 1878 Wm Carman

Electric Light experiments Sept 28. 1878
Continued

Antimonic Acid keeps its heat twice as long as platina spiral and both same color (red) —

Benzoic Acid burns up makes good lamp black
Silicic Acid " " G.

Asbestos. Incandescent — Good wind platina wire with it =

Bronze Powder takes long time get heat and stays red hot a very long time

Nitrate Silver very dull red but keeps it long time.
Carbonic Phosphorus takes a very long time to heat up and takes several seconds to cease luminosity after taken from flame.

Same with Brothine Phos —

Wachs. Phos — same and quicker —

Boneisum — not so good

Copied from page 49. E L Record
Oct 2. 1878 M Carman

Electric Light Sept 30. 1878

Effect when held in a flame by platina of

Chromium — when held in light gets red but not quite so much as platina it however keeps its redness three times as long as the platina. when held in powder and not spiral heated by H cells carbon no good

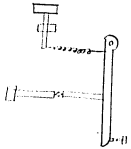
Oxalate of Cerium Burnt — I find that when I put small pieces of this on the Edge of the Burner on Burner they clear them and give off a very brilliant light and I see no diminishing of intensity in two hours I had been watching it
I find however it gets some of its brilliancy by being supplied with Oxigen as if I shut off the air in the bottom hole in burner the flame is brighter but the Cerium goes out almost entirely

Chromium — with 40 cells battery a small piece Chromium gives a light similar to Silicon (soft)

Chromic Acid — In flame — burns with very bright light and readily swells out and keeps hot but not longer than platina however —
In fact it gets hot and loses its heat both quicker than P
Copied from page 50 E L Record Oct 2. 1878
M Carman

Electric Light Sept 30. 1878

Chromic Acid burnt in flame
Residue is not a conductor of Electricity



Copied from page 51 E. L. Record Oct 2. 1878
W Carman

Electric Light Sept 30. 1878

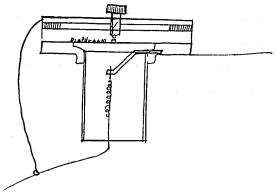
Cerium =

Chromium =

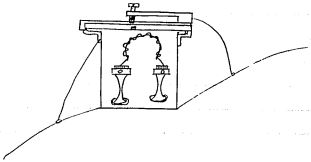
Boron from Borax in arc of carbon light good conductor
Metallic fracture brittle = form of bent cake –

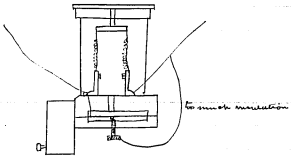
copied from page 52 E. L. record Oct 2. 1878
W Carman

Electric Light Subdivision Sept 30. 1878



Shows plan of cutting off by expansion of air working a diaphragm to close points





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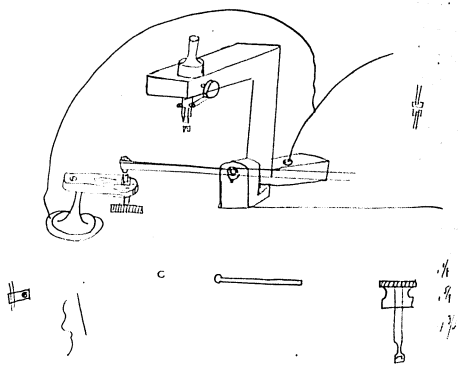
W Carman

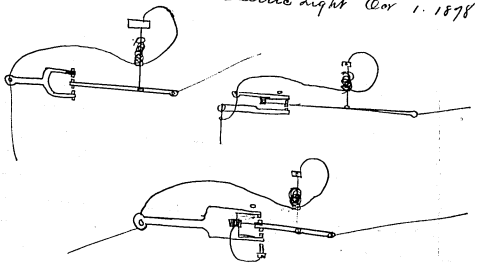
Electric Light Sept 30. 1878

make instrument for testing different



Copied from page 54 Electric Light
Oct 2 1878 Wm. Carman

Electric Light Oct 1. 1878



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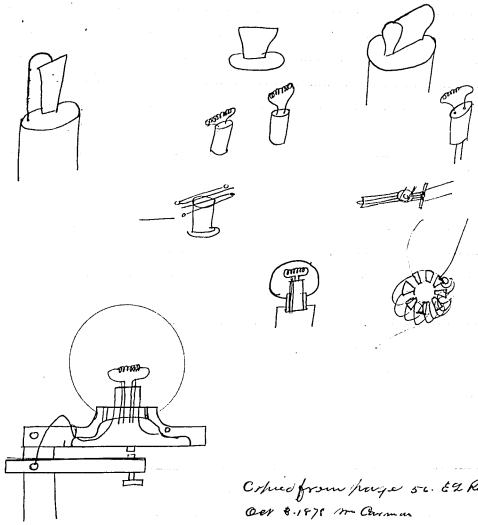
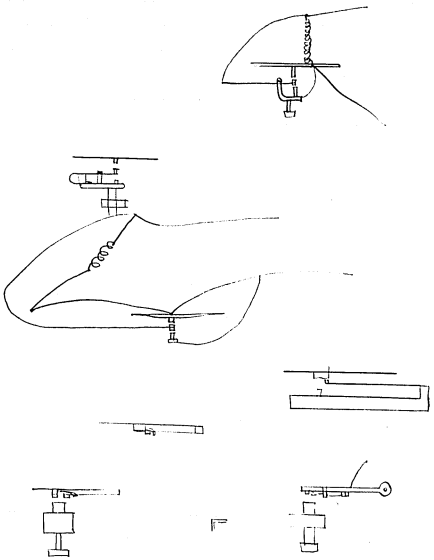
Wm Carman

Electric Light Oct 1. 1878



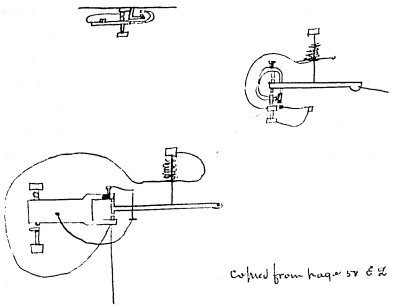
Copied from page 56. E. L. Records
Oct 8. 1878 Wm Carman

Electric Light Oct 1. 1878



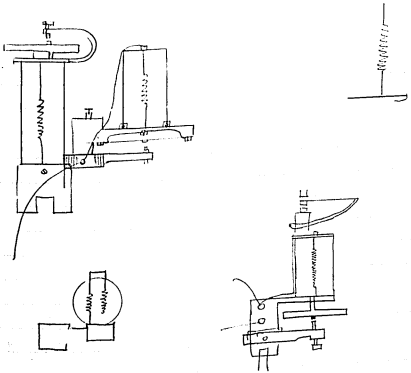
Copied from page 57 E L Record Oct 3. 1878
J Carman

Electric Light Oct 1. 1878



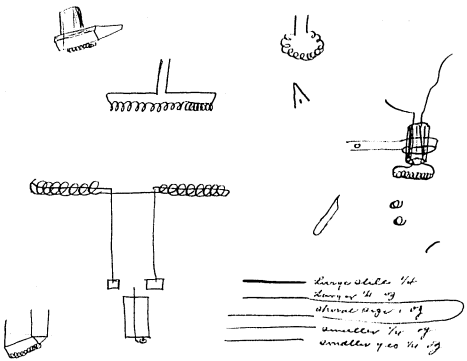
Copied from page 58 E L Records Oct 3. 1878
Wm Carman

Electric Light Oct 1. 1878



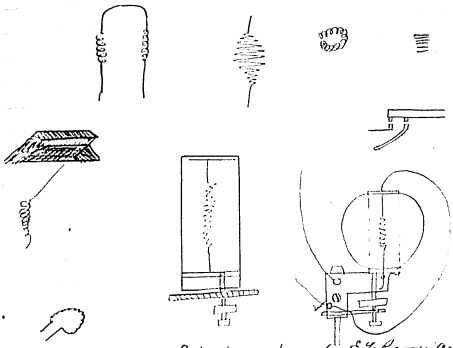
Copied this from page 58. E L Records Oct 3 1878 Wm Carman

Electric Light Oct 1. 1878



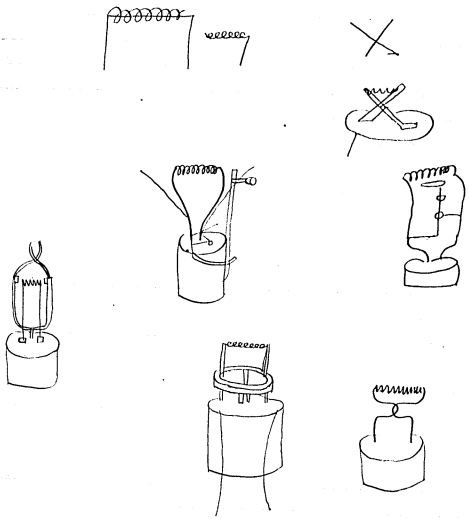
Copied from page 60 E. G. Record
Oct 8. 1878
Wm. Cumm

Electric Light Oct 1. 1878



Copied from page 61 E. G. Records Oct 3. 1878
W Cumm

Electric Light Oct 1. 1878



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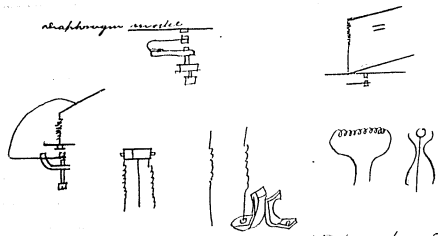
W Carman

Electric Light Oct 1. 1878

New model –
Spiral so mounted
flexible frame

diaphragm model



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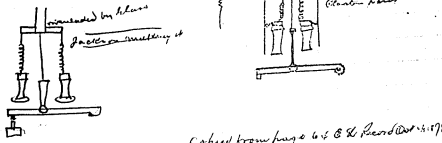
Oct 4. 1878 W Carman

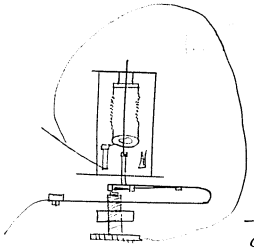
Electric Light Experiments

Double spirals are bad as even with Platinum they Sag down
with Great Heat and cut out some coils
Try this. use same size wire for
spirals and only as much in the two
as was in the one double spirale



Copied from page 64 E.L. Record Oct 5 1878
W Carman

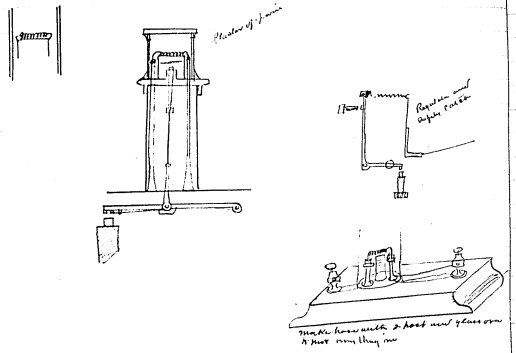
Electric Light Oct 2. 1878



Kreuzer
next one must have of
material of lever little thin and
2 platinum spirals of No 18
wire about 12 or 14 turns
on each

Copied from E. G. Reers Phy 65
Oct 11. 1878
McCann

Electric Light Oct 2 1878



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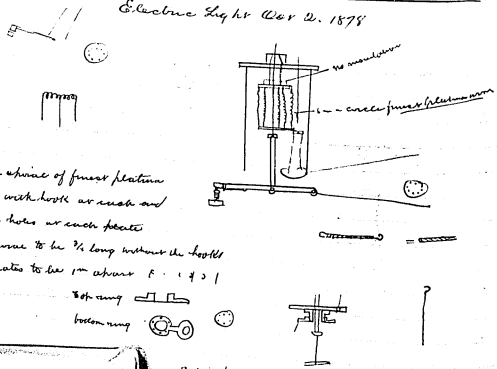
McCann

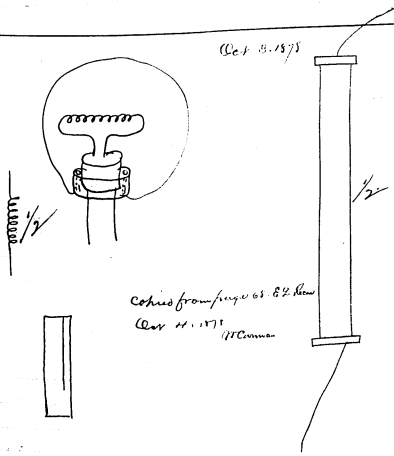
Electric Light Oct 2. 1878



make spirals of finest platinum
wire with hooks or such and
cross 6 times or such plates
the spirals to be 3/4 long without the hooks
the plates to be 1 in square 8 · 1 7 2 1

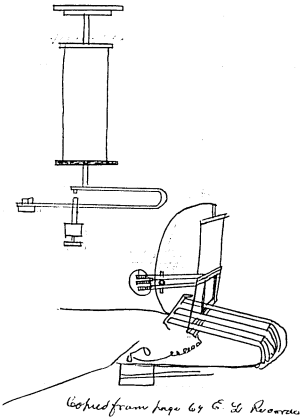
Copied from page 66. E. G. Reers Oct 11 1878
McCann

Oct 3. 1878



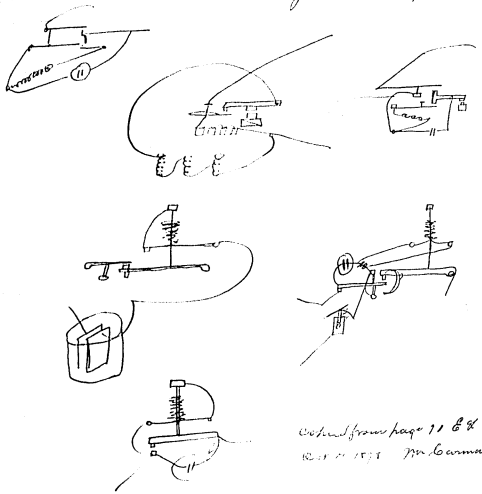
Copied from page 65 E. G. Reers
Oct 11. 1878
McCann

Electric Light Oct 3. 1878



Copied from page 64 E. L. Record Oct 11. 1878
McCarman

Electric Light Oct 3. 1878



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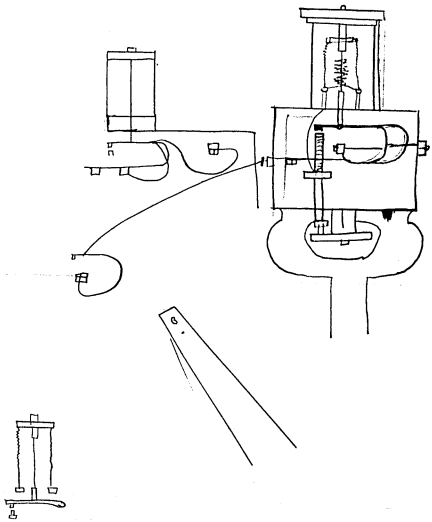
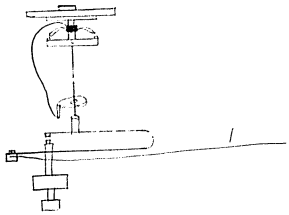
Oct 11 1878 McCarman

Electric Light Oct 8. 1878



Copied from page 71 E. & Record Oct 4. 1871
W. Carman

Electric Light Oct 8. 1878



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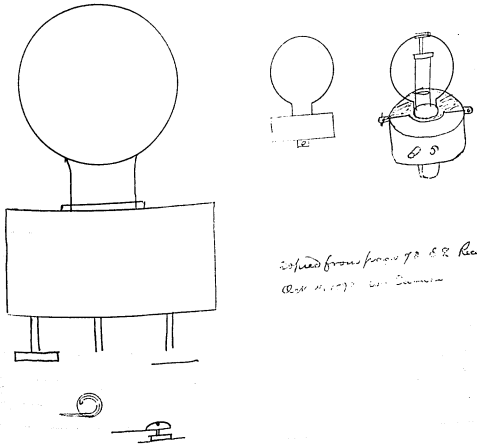
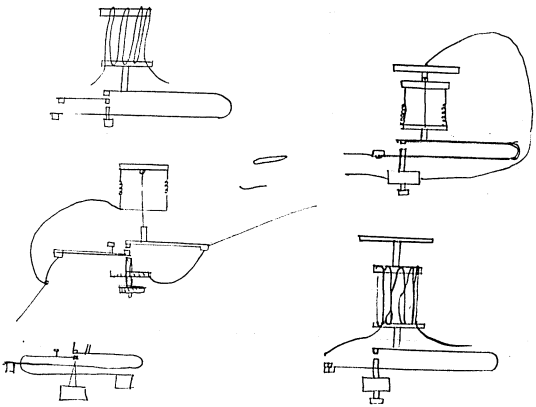
Oct 4. 1871 W. Carman

Electric Light Oct 8. 1878



Copied from page 78 E & Record
Oct 4. 1871 W. Carman

Electric Light Oct 3. 1878



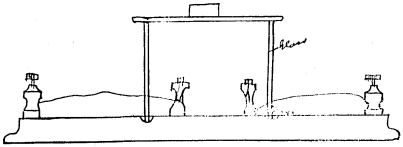
Copied from pages 74 E.L. Record Oct 11. 1878

Wm Cairns

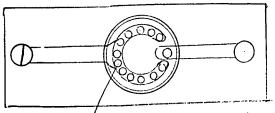
Electric Light Oct 3 1878

Krenge

make on a sounder



make connection for the inside part so that I can test them anywhere for circular or straight spirals



The holes I in the copper strip and through the base so that I can adjust the spirals close to the other one or keep further away

Copied from pages 75 E.L. Record Oct 4th 1878

Wm Cairns

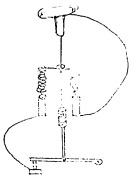
Electric Light Oct 3 1878

Jackson: —

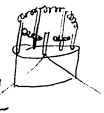
The bolt hold back for the spring at 4 was far away from the points you must put it right close up to them only 1/16 away from them

Copied from page 76 E L Record Oct 4, 1878
McCauman

Electric Light Oct 2. 1878

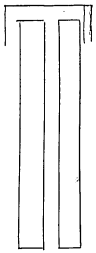


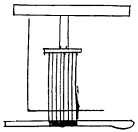
Armature [illegible] Nos

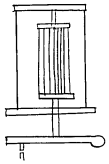


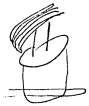
Copied from page 77 E L Record Oct 4, 1878
McCauman

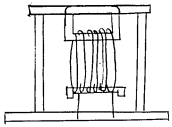
Electric Light Oct 2. 1878









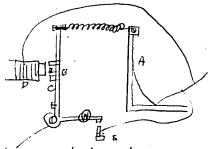


Copied from page 78 E L Record
Oct 4. 1878 McCauman

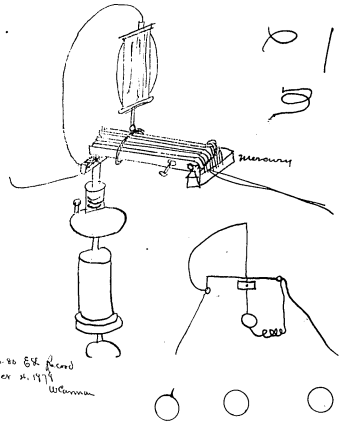
Electric Light Oct 2. 1878

Kreuz

made an experimental Instrument on a Sounder bought at Bro —
It is a lever to hold on end of spiral
B is a flexible lever holding the other end. It is provided with a double point wrapped C
D is regulating point. E is the safety point if the spiral the lever falls by weight W on to point
Make spring C very delicate and put hold back close to point

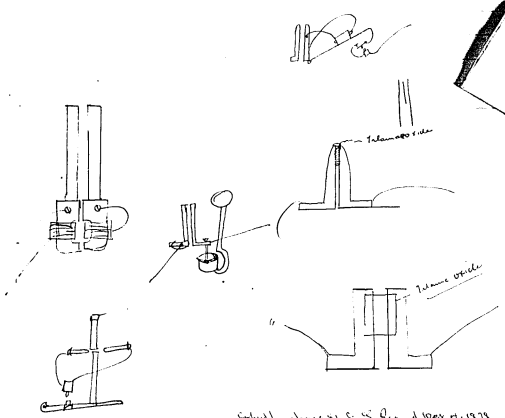


Copied from page 79 E & Record
Oct 4, 1878. W Carman



Copied from page 80 E & Record
Oct 4, 1878
W Carman

Electric Light Oct 3. 1878



Copied from page 81 E & S Record Oct 4, 1878
W Carman

Electric Light Oct 2. 1878

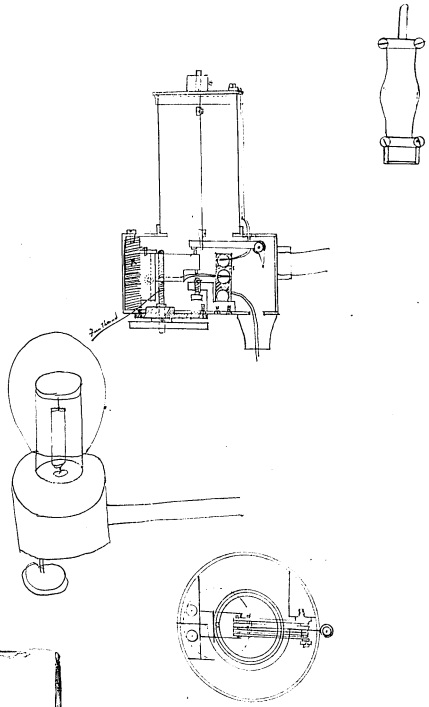
Iridium: got by melting between carbon point very good light by incandescence Has to be very hot before current will go through it. Has a very thick oxide around but with 25 cells current get a deflection of 1 degree on 1 core broke it and got a deflection 30 on 1 core and 16 on 4 core

Manganese: ditto

Bad conductor. cannot get nothing at all through the oxide and only 1½ degrees through the metal when broken! — on 1 core and 25 cells current

Copied from P. 82 E.S. Record Oct 4, 1878
W Carman

Electric Light Oct 3 1878

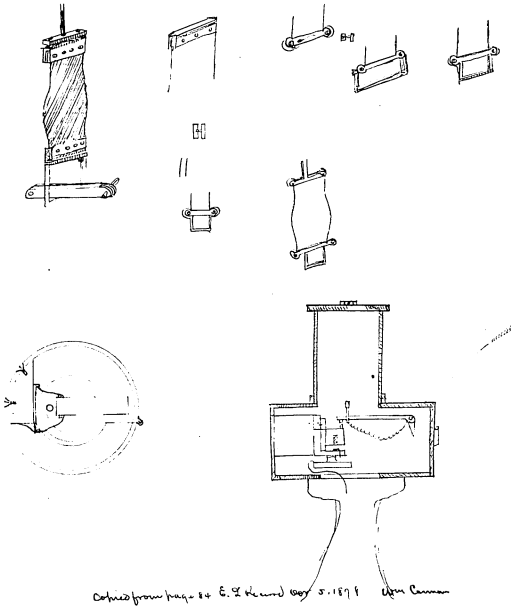


Copied from page 23 E. Light Record oct 5. 1878

W Carman

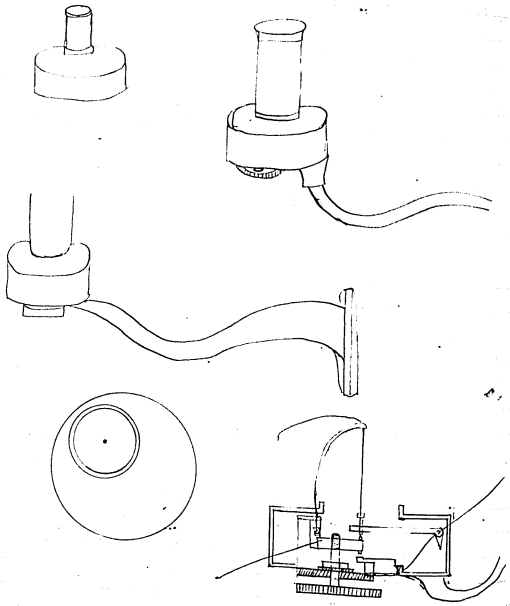
Electric Light Oct 3. 1878

way of fastening the platina foil at the ends



Copied from page 24 E. L. Record Oct 5. 1878 Wm Carman

Electric Light Oct 3. 1878

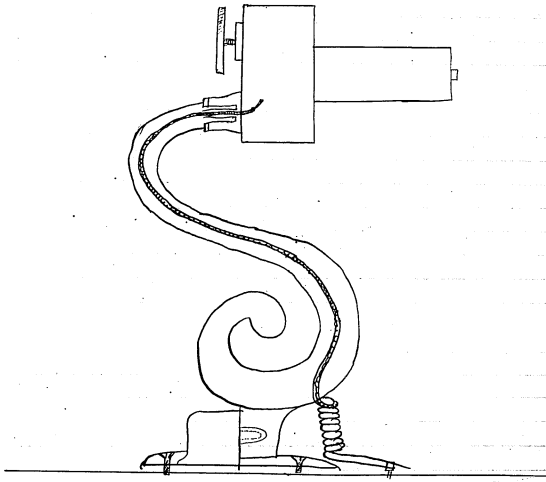


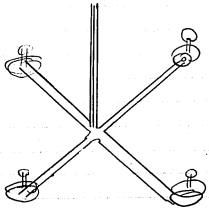
Copied from page 55. 8 Z Recd Oct 5. 1878
W Carman

Electric Light Oct 3. 1878

Subdivision

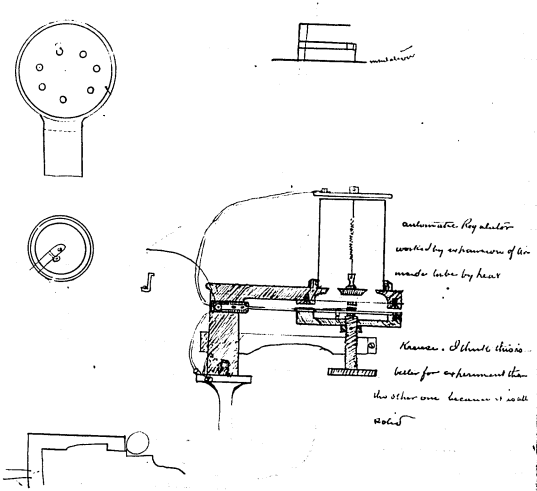
Wall Bracket





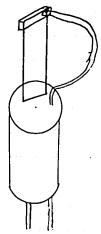
Copied from page 56. 8 Z
Recd Oct 5. 1878
W Carman

Electric Light Sept 30. 1878



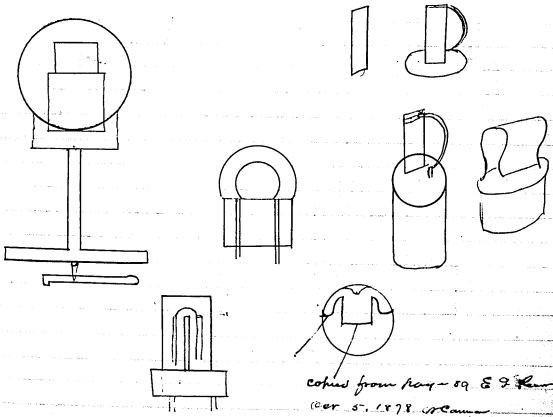
Copied from page 87 Electric Light Record
Oct 5. 1878 Wm Parman

Electric Light Oct 4. 1878



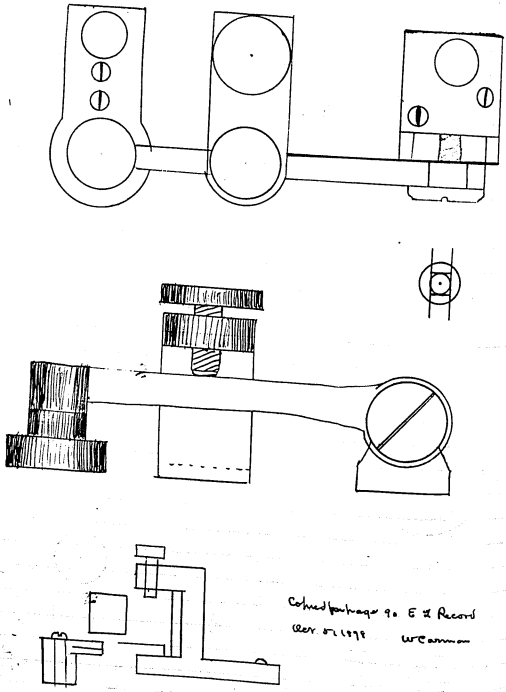
Copied from page 88 E L Record Oct 4 1878
Wm Parman

Electric Light Oct 4. 1878



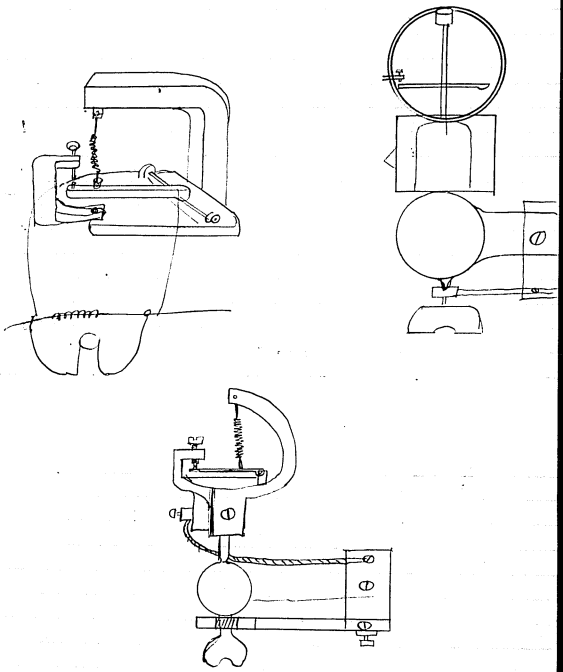
Copied from page 89 E L Record
Oct 5. 1878 Wm Parman

Electric Light Oct 3. 1878



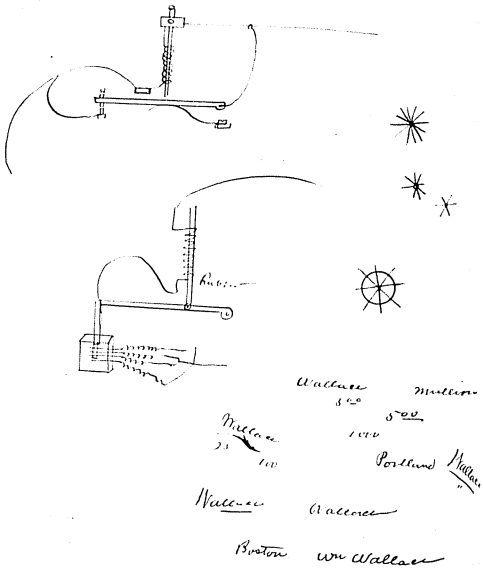
Entered from page 90 E & L Record
Oct. 5. 1878 W Cannon

Electric Light Sept 9. 1878



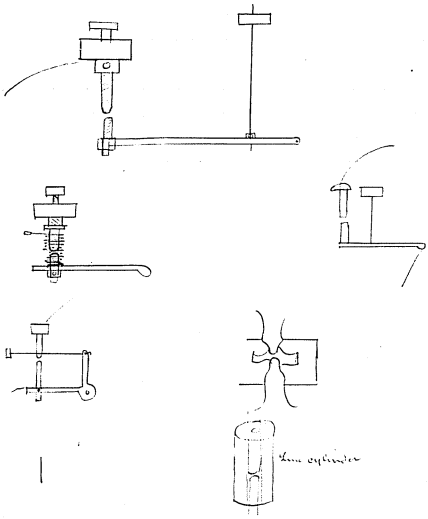
Entered from page 91 E & L Record this 7th day of Oct 1878
Wm Cannon

Electric Light Sept 9. 1878



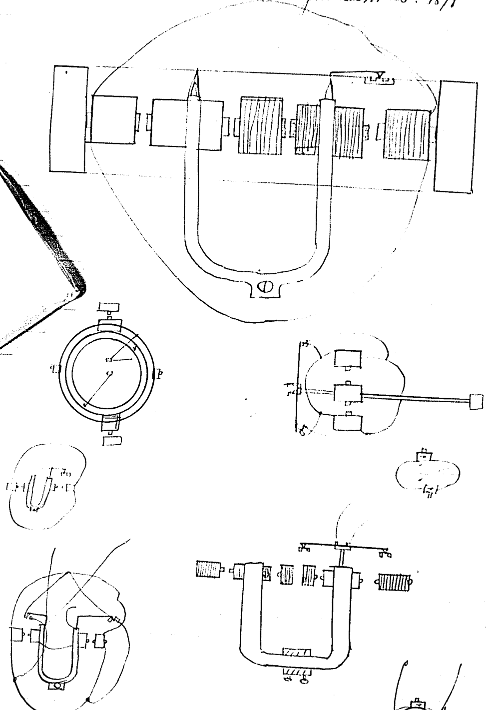
Copied from page 94 Electric Light Record
Oct 7. 1878 W Cunnan

Electric Light Sept 25. 1878



Copied from page 93. & 2 Records
Oct 7. 1878 Wm Carman

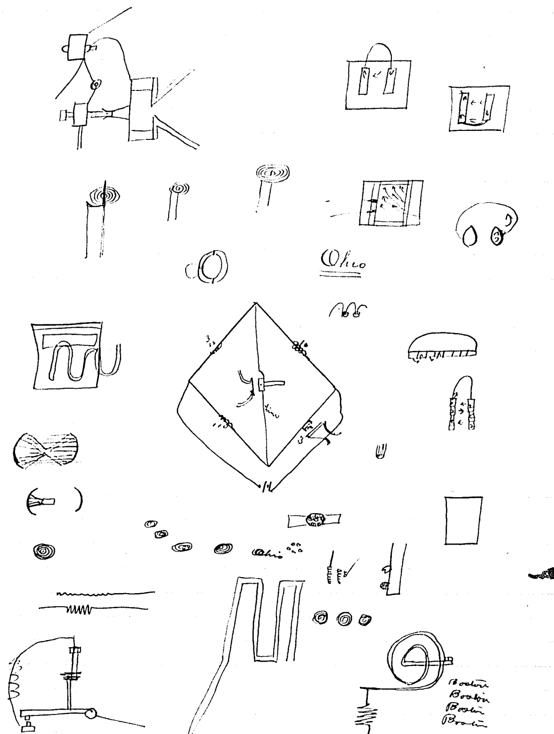
Electric Light Sept 25. 1878



Stock Printer
Pressure Relay
Megaphone
Telephone
Electric Pen
Tasimeter
Phonograph
Reflecting Thermostat
" Voltameter
Resonant Fork
Motograph Relay
Pressure Relay
Musical Telephone
[illegible]
[illegible]
[illegible]
Harmonic Engine

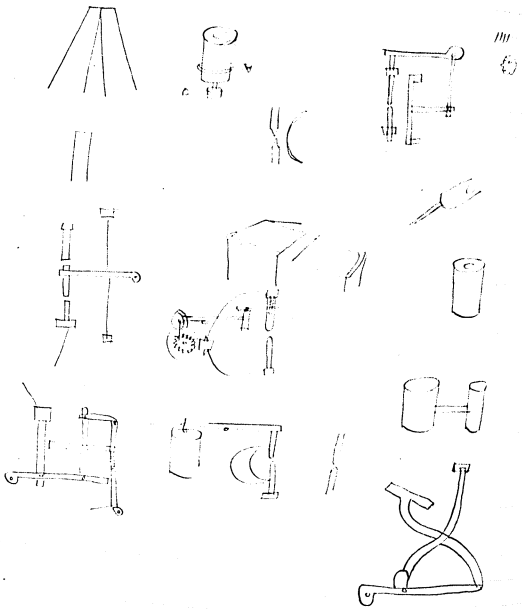
Copied from page 94 E. L. Record Oct 7. 1878
Wm. Carman

Electric Light Sept 27. 1878



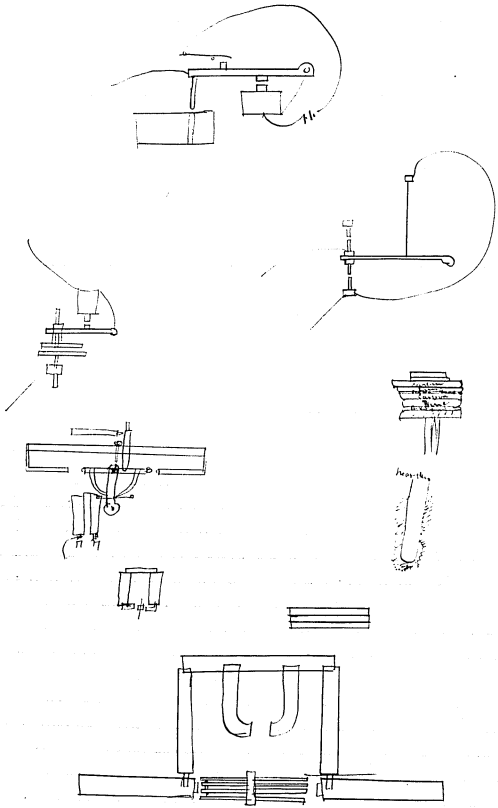
Copied from page 95. E L Record Oct 7. 1878
W Carman

Electric Light 1878



Copied from E. L. Record Page 46. Nov 7. 1878 Com Carman

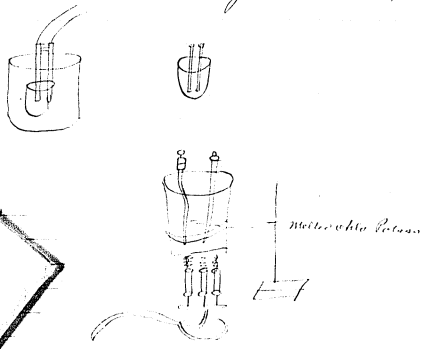
Electric Light Sept 27. 1878



Copied from page 47 E. L. Record Nov 7 1878

W Carman

Electric Light Sept 28. 1878



Copied from page 98 E & L Record Oct 7. 1878
W Carman

Nov 27. 1878

Electric Light, make wedges of Platinum with Aluminum
Fine mica platinum for incandescence. I think that a better aluminum or Platinum will get Rid of the brittleness
Between the two cells which I have wound the incandescent strips
fine finely divided. Ammonia-alum this will melt and
the water will evaporate, this will keep heat from radiating
Try Chromium. between platinum points. make some sulphur
silver by melting (Hydrosulphuric Acid Chl ag) Sulphide Silver. to
malleable & soft may make a fine for telephone
Try powered antimony & Bismuth (carefully powered) for telephone
buttons
Also amorphous Antimony (to make X. P Hot - y Big Blow
Note coat thin form plate with 1/16 inch of melted resin. Shellac
to crucible - make a horse rocked tin diaphragm
Try Tungsten = to make (Big Blow P H2 L)
Molybden. —— —— (" ")

Copied from page 44. E & L Record Oct 7. 1878 W Carman

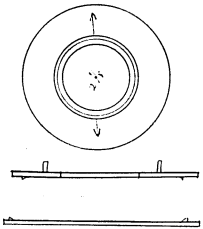
Electric Light Sept 27. 1877

make a lamp wick of pressed platinum black and
asbestos on outside. absorbing a spirit

Electric Light Try palladium

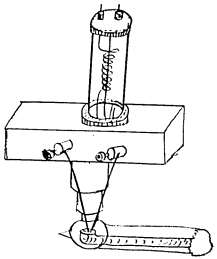
Copied from page 100 E. & L Record Oct 7. 1878
Wm Carman

Electric Light Oct 5. 1878



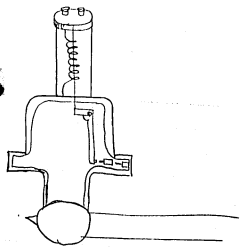
Copied from page 101 E & L Record Oct 7. 1878
W Carman

Electric Light Sept 17. 1878



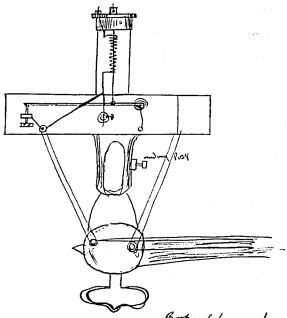
Copied from page 102 E. L. Record Oct 12. 1878
Wm Carman

Electric Light Sept. 17. 1878.



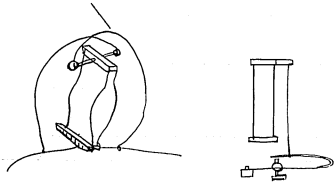
Copied from page 103 E. L. Record Oct 12. 1878
Wm Carman

Electric Light Sept 19. 1878



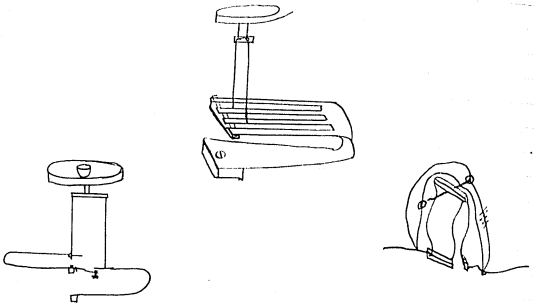
Copied from page 104 E. L. Record
Oct 12. 1878 Wm Carman

Electric Light Oct 5. 1878



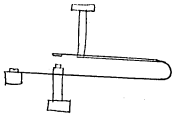
Copied from page 105 E. L. Record Oct 12. 1878
Wm Carman

Electric Light Oct 5. 1878



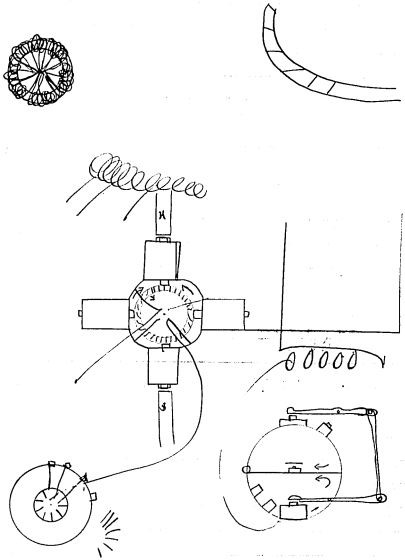
Copied from page 106 E L Record Oct 12. 1878
H. Carman

Electric Light Oct 7. 1878



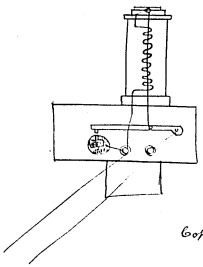
Copied from page 107 E L Record Oct 11. 78
H. Carman

Electric Light Oct 9. 1878



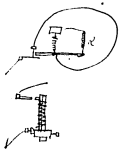
Copied from page 108 E. L Record Oct 12. 1878
H. Carman

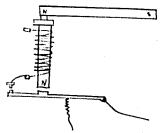
Electric Light Oct 9. 1878

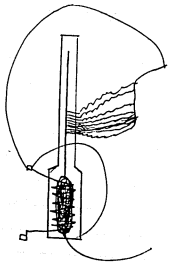


Copied from Page 109 E & S Record Oct 13. 1878
W Carman

Electric Light Oct 9. 1878

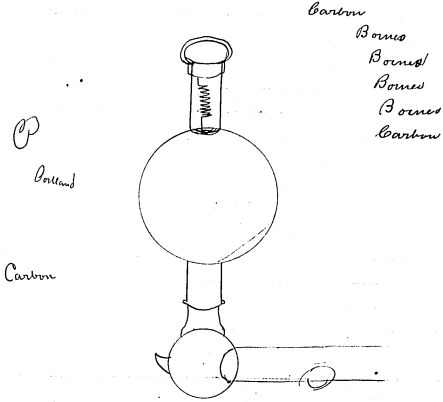






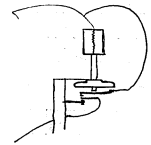
Copied from Page 110 E & S Record
Oct 12. 1878 Wm Carman

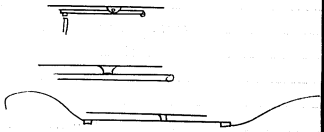
Electric Light Oct 9. 1878

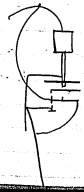


Copied from page 111. E. & S Record
Oct 12. 1878 W Carman

Electric Light Oct 9. 1878



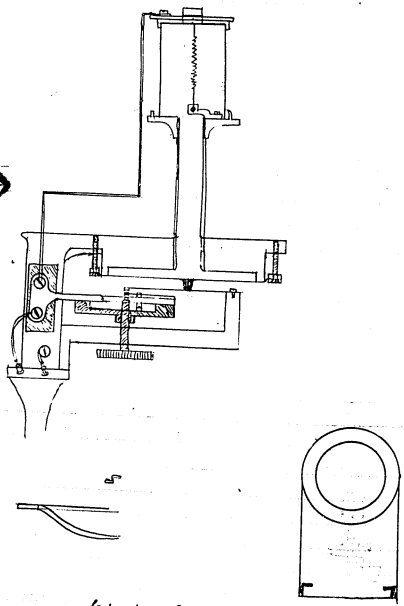




Copied from Page 112. E. & S Record Oct 13. 1878
Wm Carman

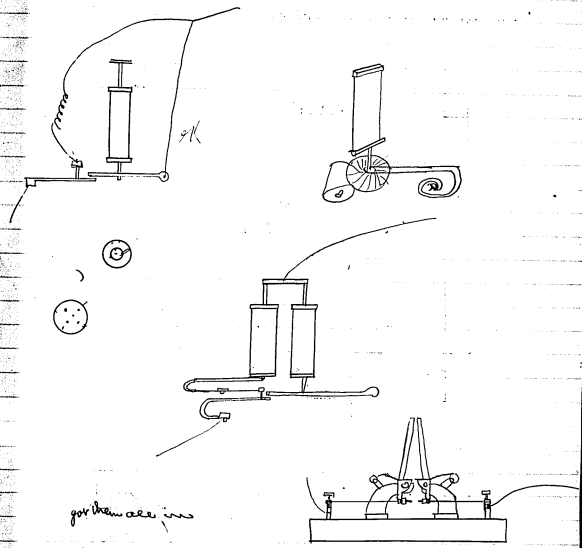
Electric Light Oct 7, 1878

Light regulated by expansion of a column of air heated



Copied from Page 113. E & Records Oct 10 1878
von Cannon

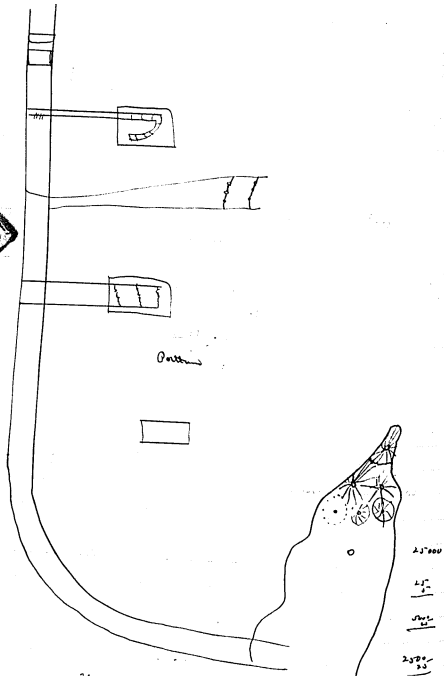
Electric Light, Oct 8, 1878



gas therm alec. inc

Copied from P. 114 E. & Record Oct 14. 1878
von Cannon

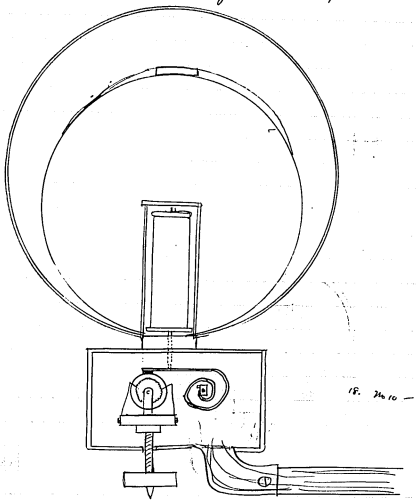
Electric Light Oct 8. 1878



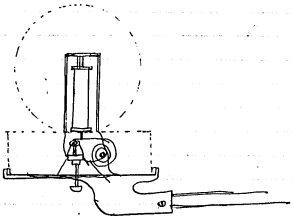
Copied from Page 115 E. L. Record Oct 14 1878.

W Carman

Electric Light Oct 8. 1878



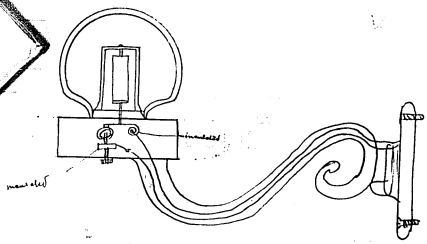
18. No 10 — 1/4 dia



Copied from Page 116 E. Light Records Oct 14. 1878

W Carman

Electric Light Oct 8. 1878



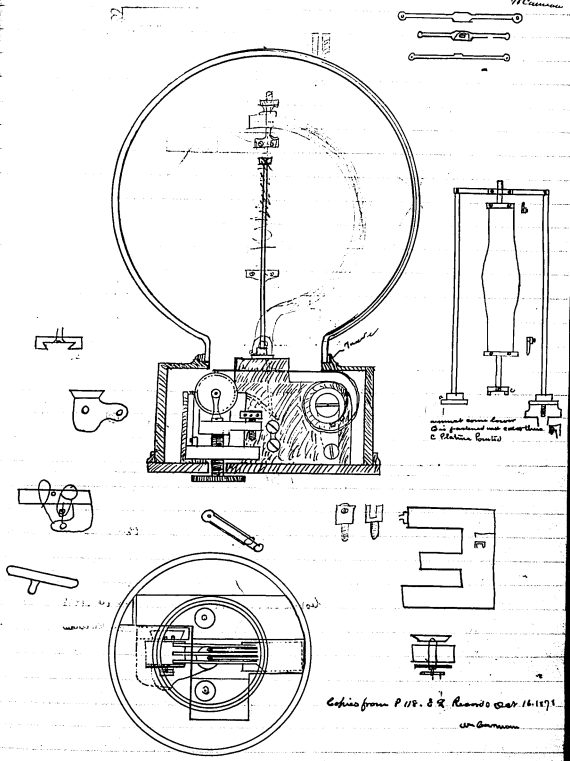
Copied from page 117 E. L. Record Oct 16. 1878

W Carman

Electric Light Oct 9 1878

The sketches drawing done on this page were drawn on Oct 23. 78

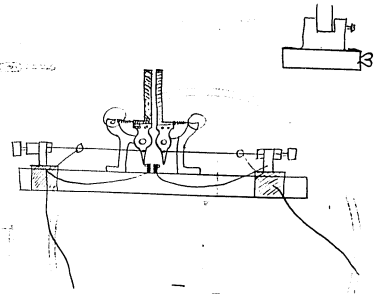
W Carman

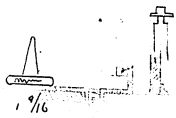


Copied from P 118. E. L. Record Oct 16. 1878

W Carman

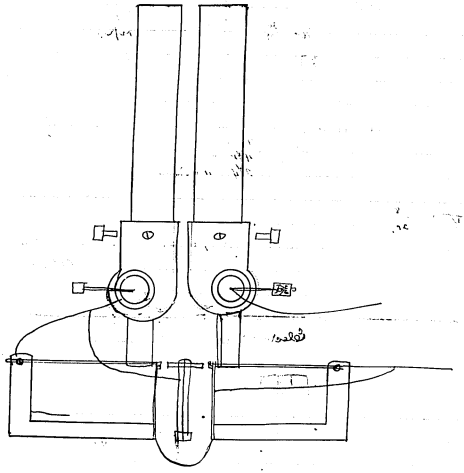
Electric Light - Oct 9. 1878





Lecture on page 119 - E. & Record Oct 14. 1878
W. Carman

Electric Light - Oct 12, 1878



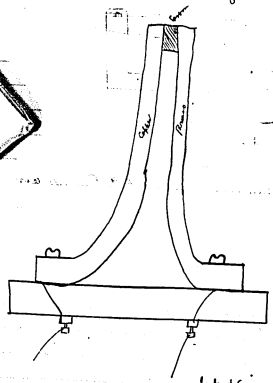
Lecture from Page 120 E & Records Oct 14. 1878
W. Carman

Electric Light Oct 14. 1878

Copied from page 121 E & Record Oct 14 1878

M Carman

Electric Light Oct 9. 1878

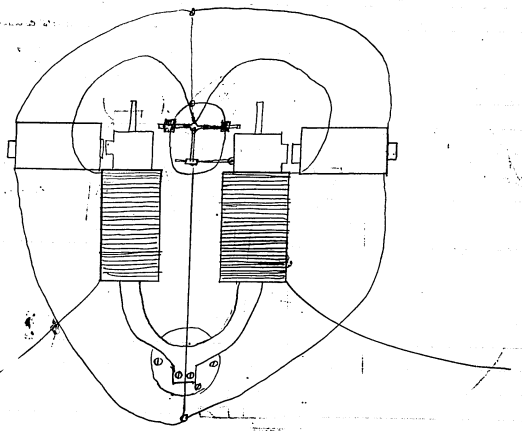


Copied from Page 122 E & Record Oct 15 1878

M Carman

Electric Light Oct 18. 1878

Horseshoe magnets Electric Generator

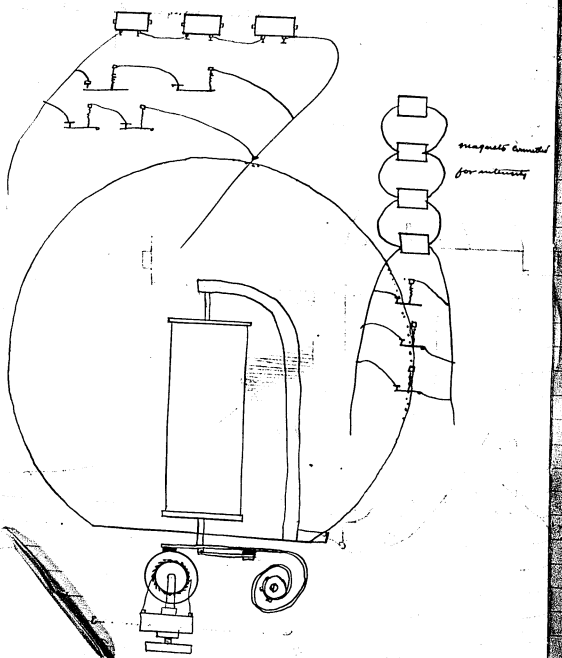


Copied from E & Record 123 Page Oct. 19. 1878

M Carman

Electric Light Oct 8. 1878

Three magnetos connected for intensity



Copied from page 124 E & Recd Oct 28. 78

Mc Cormick

Electric Light

Nov 15th 1878

Law.

With a given wire having 1 Ohm resistance and certain length brought to a given degree of temperature by given battery. It will when coiled in such a manner that but one quarter of its surface radiates, its temperature will be increased 4 times as, — + battery will bring it to the temperature of straight wire. Or the same battery including wire whose total resistance is 4 ohms is inserted will bring it to the same temperature as straight wire.

This was actually determined by trial.

The amount of heat lost by a body is in proportion to the radiating surface of that body. If one square inch of platina be heated to 100 deg it will fall to say zero in one second, whereas, if it was at 200 deg it would require 2 seconds.

Hence in the case of incandescent conductors if the radiating surface be 12 inches and the temperature on each inch be 100 or 1200 for all, if it is so coiled or arranged that there is but 1/4 or 3 inches of radiating surface then the temperature on each inch will be 400. If reduced to 3/4 of an inch it will have on that 3/4 1600 deg Fahr. notwithstanding the original total amount was but 1200 because the radiation has been reduced to 3/4 or 1/57 units, hence the effect of the lessening of the radiation is to raise the temperature of each remaining inch not radiating to 1200 deg. If the radiating surface was reduced to 3/32 of an inch the temperature would reach 6400 deg Fahr. To carry out this law to the best

advantage in regard to platina &c then with a given length of wire to quadruple the heat we must reduce the radiating surface to ¼ and to do this in a spiral ¾ must be within the spiral & ¼ outside for radiating = hence a square wire or other means such as a spiral within a spiral must be used. These results account for the enormous temperature of the Electric Arc with one horse power; As for instance if 1 H.P. will heat 12 inches of wire to 1000 degs Fahr and this concentrated to have ¼ of the radiating surface it would reach a temperature of 4000 degs or sufficient to melt it but supposing it impossible the further concentration to ⅛ its surface it would reach a temperature of 16000° and to 1/16 its surface which would be about the radiating surface of the Electric Arc it would reach 64000 degs Fahr, of course when light it radiates in great quantities not quite these temperatures would be reached

Another curious law is this. It will require a greater initial battery to bring an iron wire of the same size and resistance to a given temperature than it will a platina wire in proportion to their specific heats, and in the case of Carbon if a piece of Carbon 3 inches long ⅛ diameter with a resistance of 1 ohm: it will require a greater battery power to bring it to a given temperature than it would a cylinder of thin platina foil of the same length diameter and resistance because the specific heat of Carbon is thirty times greater, besides if I am not mistaken the reflection of a roughened body for heat is greater than a polished one like platina which may be published

A gas jet equals a Jablochkoff Candle when concentrated in the same space.

A gas jet has 10 square inches radiating surface 15 candle p.
If reduced to 2½ " " " " 60 " "
" " 0.62 " " " " 240 " "
" " 0.15 " " " " 960 " "

The latter radiating surface is about equal to the radiating surface of the arc of a Jablochkoff Candle, hence an ordinary gas jet if concentrated to the size of the Jablochkoff arc would give the same light, or in other words the same power which gives a gas jet of 15 Candle power will give 1000 by concentration

If the radiating power or time of a substance is decreased, the gain in light is directly to the decrease for instance if I could with platina coils obtain 4 burners of 15 C.P. each per H.P. then by reducing the radiating power 50 per cent I would obtain 8 burners.

Experimental Researches, Vol. 2, Cat. 995

The only entry in this volume is a list of eight "axioms" in Charles Batchelor's hand. These axioms are broad generalizations relating to acoustics, anthropology, and the nature of matter, energy, and the universe. They are dated May 2, 1878. Only pages 1 and 3 of this 640-page volume have been used.

E-1691

Axioms.

May 2nd 1898.

1. Articulate Speech consists of two parts musical sounds and clang sounds, the first varying in pitch and volume with enormous rapidity, while the latter is composed of vibrations having no definite relation with one another.

2. The diaphragm of a telephone or phonograph is delicate to vibrations which follow each other with some degree of regularity and very insensitive to the same vibrations when they do not follow each other with regularity, hence the vowel sounds powerfully affect the plates and the hissing or clang sounds do not affect it so powerfully. The diaphragm equals the ear in the reception and reproduction of sounds composed of musical vibrations, but is far inferior to the ear in dealing with clang sounds. I infer that the enormous complications of the human ear is more especially designed by the Creator to analyze clang sounds, such as the dropping of water, clapping of hands, etc, etc. sounds which the Phonographic disc seems to be unable to do.

3 That the Universe has always existed and will always exist are selfevident ~~propositions~~ facts and that space is infinite is also self evident, because the mind of man cannot conceive the creation of so much matter for nothing or the destruction of the same nor can he conceive a point on one side of which is space and the other side no space

4 Each ultimate particle of matter is endowed with intelligence.

5 Those nations whose people live upon a mixed diet are the most civilized. A mixed diet gives a diversity of ideas, ideas coming from the oxydation of food: instance the greater learning in cities where the diet is more mixed than in the country; and the superiority of the French English and German speaking people, and per contra the Chinese who live mostly on rice who will continue to think in the same channels as long as they are confined to this one cereal

6 The dissipation of energy at the loss which takes place in the transformation of one force into another is lost in other forms of energy unknown to us, hence the existence of unknown forces other than light, heat, electricity etc.

7 All matter is under strain of gravitation, hence if Planetary changes cause an increase or decrease in the attraction of gravitation, it would account for a deal of force on our earth.

8 Either Light exerts an attractive power and lifts organic matter against gravity as for instance the rise of a potato vine in a cellar to a hole in the roof of same, or else a potato vine is endowed with intelligent energy

Experimental Researches, Vol. 3

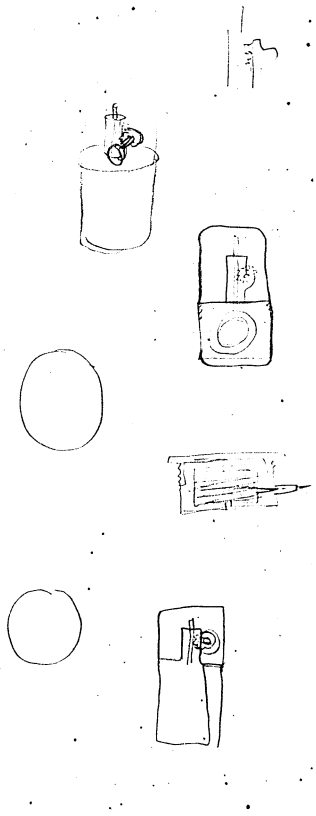
This volume is missing. Two volumes in the Menlo Park Notebook Series for 1879 (N-79-01-01 and N-79-02-24.2) contain references to electric light caveats copied into this volume by William Carman in March 1879.

Experimental Researches, Vol. 4, Cat. 996

This notebook covers the periods August 1876-January 1877 and June-October 1878. The notes and drawings, some of which are signed and dated by Edison, deal with the electromotograph, etheric force, electric drive for sewing machines, and octruplex (acoustic) telegraphy. There are also extensive tests of chemical solutions, some carried out by Edward H. Johnson, and a patent specification on the chalk-drum telephone, dated 1879.

The book also contains a series of notes and drawings copied into it by William Carman. The originals of this material can be found in the following locations: pages 75-97 in Unbound Notebook, Vol. 18; pages 175-192 in NS-78-012, Unbound Notes and Drawings; and pages 270-283 in NS-78-003, Unbound Notes and Drawings. The book contains 640 numbered pages.

Blank pages not filmed: 106-173, 194-269, 284-639.



Electro Motograph.

Aug 24/96.

Experiments today – To obtain a solution which will show greatest difference in friction with the minimum of Polarization

Note We have found (Aug 23) that passage of Current through any Substance Containing Strong Solution of Caustic Soda – that great Polarization is had. If the Accump. Spaniel one Constantly used this Polarization is not noticeable & no inverted Current is discharged from the Electrodes. But if the Current is allowed to remain closed – the point resting upon one spot – Excessive Polarization takes place – so great that a Current from 25 Carbon Bath is insufficient after 2 or 3 mins to work promptly an Ordinary Relay – but if the Point be moved to a new surface on the shaft the Current passes with full strength, & the Relay work strong. If the point remains on same spot & the Current is reversed – the same effect is had – but again rapidly weakens. We have also found that this Polarization is not so great in some solutions as in others for instance if we use 4 strips cut of different solution respectively Fused Cyanide Potassium, Pyro Gallic Acid – Caustic Soda – & Acetate Mercury & Caustic Potash – they Polarize very rapidly. Except the last which requires a long passage of the current – to show any Polarization. This explains why the best results have heretofore been obtained by the Mercury Salt. And also why a Shunt could not be used with solution which Polarize rapidly

– The Electrodes sending an Inverted Current thus disturbing their own adjustment, by Circulating in the Shunt.

The above we consider a very important "Peg" discovery – Although noticed many times previously – we were not forcibly impressed by it because of the feebleness of the showing – the Caustic Soda however showed the Peg so well defined as to compel his recognition – whereupon a great many therefore unexplained Phenomena – become Easy of Explanation

It is noticeable that Caustic Soda is an Element of Maximum Effect, whatever direction used it appears to produce results more marked than other solutions.

With this New Element in mind – we now proceed to Test for a Non-Polarizing Agent Either to use Independently or to Combine with Caustic Soda. –

Elk. Coo Ohms. 25 Ally Pt Carbon
Hand Motograph – W.U. Relay 140 ohm in Ckt.
Hand Points – Round 1/16 Dia Drain (Oval End)
Platt. Pt. + Tgt – Surface
In Each case we use. Over 20 d/7 ammeter Gal. as next below in Coil. No 10. on Load –

No 1

Ord. Auto Paper – Treated G. Pattern.
When quite wet scarcely any Polarization – scarcely any working difference
Quite Dry. Resist Rel. Great Polarization + Gd. Mag. Dif.

No 2.

Mono-chloro. Acetic acid Res low. Poly. low
Working Dif O – Phenomena Paper ~~Comes~~ adhere to Flat Platin – on Ogden –

No 3.

Grape Sugar – Res. Variable on Dif metals #
Re on Tin. Lead. Platinum Greatest
The Difference of Res. betw. Tin + Platinum Enormous.
Polarization very rapid. Probably varies on the Surface but this may be caused by change of Resistance
Re working Dif. It increases friction on Dif.

No 4

Acetate of Strychnine – Res. high – Poly. Rel. No Diff.
Res. Friction on Dif. Marks on Dif. + Silver –

No 5.

Mica Ammoniacal – Res. Low. Poly. Med. Least on Pat. Greatest on Aluminium + Nickel – Dif. medium –
Reaches 10,000)

No 6.

Perchloride Potash – Res. low. Poly. gk. Dif Medium

No 7.

Lacto Phosphate Bismuth – Res high Poly gk. Dif 0

No 8.

Phosphate Manganese – R. Low. P. gk. D. 10,000 Wk. sharp.

No 9.

Sulphate Minimum – R. Low. P. Mid. D. 10,000. Nix.

No 10.

Phosphate Zinc. R. Mid high P. gk. D. Nil.

No 11.

Hypo. Sulphate Barium R. Lets. P. Slow. Very slow on Platt
Dif Nil. Inc. Fric on Dif.

No 12.

Iodide Lime. R. Very low. P. Very Slow. Dif nil. Blk Mk only. Iodine Mk on Or

No 13.

Lactate Quinine R. Very High P. Mod. D. Nil.

No 14.

Sulphate Strychnine = R. High P. Very gk. Dif Nil.

No 15.

Chloride Propalamine - R. Low. P. gk. Dif 10,000 Nil -

No 16.

Saponin - R. Very High P. Good Strong Dif - 10,000 feel it.

No 17.

Nitrate Strychnine R. High. P. gk. D. 10,000 Nil.

No 18.

Linear Caustic R. Low. P. Very gk. D. Nil. Blk Mk on Ky. Inferior

No 19.

Chloric Acid R. Low. P. gk. D. 10,000 feel it. Red Mk on Ox. Plat. 10,000 - Sensitive - Sty.

20

Sulph. Cinchonidin. R. High. P. Very gk. D. Nil.

21.

Chloride Aluminum R. Low. P. Very gk. D. 10,000 feel it -

22

Iodic Acid. R. Low. P. gk. D. 10,000 Nil. - Faint Blk only. Glass

23

Sir Nitrate Iron. R. Low. P. Good. D. Nil.

24.

Iodide Ammonia R. Very Low. P. gk. Dif Nil. Inc. fric. on Ky. Strong Inc. Very noticeable on 10,000 - Fric. Iodine Mk on Ox.

25.

Valerianate Potash. R. Low. P. gk. Dif. 10,000 - feel it - D. Inc. fric. on Ky. Inc. Faint Blk Mk On Ox.

26

Nitrate Uranium R. Low. P. Very gk. - gk. Mk on Ky. Dif 10,000 Slight Yellow Mk on Ky.

27

Uric Acid. R. Low. P. gk. Dif 0 -

28

Pepsin. R. Very Low. P. Very Slow. D. 10,000 ok. Ot. Short.

29

Ferrid Cy. Potash. R. Very Low. P. Very Slow D. Nil: This is a saturated Sol.

Blue Mk on Ox. Mk Very Strong thro. 10,000 -

#

Phosphate Potash - R. Low. P. Slow. Ex. on Plat. Apparently to Poly on Plat. Dif 10,000 - 9,000. With Pressure it very Strong through. 10,000 Thru.

31

Tungstate Soda. R. Low. P. Very gk on all but Tin & Plat. apparently nonexistent

Dif. Strong on 10,000 Best on Metals Tolerably gk. Not feel on Plat. & Tin.

32 = Chloride Nickel. R. Low. P. Quick. Dif Nil.

33 = Bin. Oxalate Potash - R. Low. = P. Mod. gk. Dif. 10,000

34 = Sulphate Cadmium = R. Low. P. Very Slow. - Probable Insoluble } Dif Nil. Blk Mk on Ky. Inferior

34 = Formate Soda = R. Low } P. Very Slow on Plat. - Dif. on Metal. } D. Strong Weak on Plat. Good on Nickel Thinc Red. of Paper on Aluminum Very gk. -

35 = Lactate Zinc. R. Low. } P. gk. } Dif Nil on 10,000 =

36 = Tri. Chromate Ammonia - R. Low } P. Very Slow Exp. on Plat. Dif on 10,000 Nil.

37 = Citrate Potash = R. Low } P. Varies on all Metals - Zinc Quick. Plat. None = D. Strong on 600 10,000 Nil.

38 = Nitrate Magnesia R. Low / P. Pretty Quick. / Dif Nil =

#

39 = Tartrate Potash - R. Low / P. Quick on all Metals - Very Slow Plat. not Nickel and Zinc / D. Strong on Plat. Thru 30,000 Inc. Fric. on Ox.

40. Oxalate Soda - R. Low / P. Quick. Except on Plat. Plat. gk / D. 10,000 =

41 Acetate Baryta R. Low / P. gk. / D. 10,000

42 = Bi-Sulphate Potash - R. Low / P. Variable on Dif Metals / D. Nil

Phenomenon - Low. of Paper on Aluminum on Ky.

Great. On Ox. Low. Contact - Ex. Confirm

a Statement Noticed in a Scientific Paper. That the Res. of Aluminum Electrodes varied according to Direction of Current

43. Phosphate Soda - R. Low. / P. Variable / P. none on Pt. Plat / D. Strong on 20.000.

44 Citrate Ammonia - R. Low / P. Variable / P. Good on Plat. / D. Very marked on 20.000 others -

45 Sulphate Magnesia R. Low / P. Good. /
Sec. Fric on Hy. Common on two others By Inc. Res of Pt to 40.000 other action is Reversed. - & it becomes Very Strong the Hy. & Maintains its direction.
On Hy. it adheres to Plat (Pt Pt)

46. Borate of Soda = R. Low / P. Good - almost Insolubles items
On two. Sec. Fric on Hy. On 10.000 Reverses action

47. Syro Gallic Acid / R. Low / P. gk. / D. Nil Blk Ppt on Hy.
Yellow Ppt on Ox. - Most sensitive - Pot if thro. 10 000

48. Bi Chromate Potash. R. Low. P. Variable, Best on Plat Strong & Scarcely any -
D. Mod. on 10.000 - Pot if on 40.000 =

49. Bi Bichromate Potash R. Low. P. Variable Best on Mod all / D. Strong on 10.000 Pot if on 40.000

50. Gum Arabic. R. Low. P. Good. on most of Metals. } D. Strong On 40.000

51 Gallic Acid. R. High P. gk. D. Good on 10. Pot if on 40.000

52 Licorice R. Low. P. Mod. D. on 600 Enormous. Mod on 10,000 =

53. Formate of Copper R. Low. P. Mod. D. 40. nil -

54. Acetate Mercury & Caustic Potash.
Rec. Very Low - P. on Hy. Variable on all
Polarizes quite rapid on all Except Platinum
Apparently none on Platinum & Platinum
On Oxygen - P. Good. on all. Sec. Platinum
2d Test - Shows slight Pol. on Hy. on Platinum
Diff. Very Strong on 50.000

55. Bi Carbonate Soda Rec. Low. P. Variable on Ox & Hy
None on Ox. when reacts on Nickel -
Diff. Strong on 50.000. —

56. Bromid of Potassium. R. Low. P. Scarcely any on Hy -
Except on Silver. None on Ox. on any Metals
D. 10.000 =

57. Nitrate Potash. R. Low. P. none on Hy. or Ox.
Dif. Slight On 20000. -

58. Bermuda Arrowroot R. Low. P. Variable, Best on Mosh On Hy. On Ox. Variable none
On Plat - Dif good on 20.000.

59. Bromide of Cadmium R. Low. P. Feebly.
R. Very High on Aluminium. P. Best. on Ox.
Gives a Black Ppt on Hy. Dif. None

60 Chlorate of Potassium R. Low - P. None -
D. Very Strong on Hy & Fair On Ox. on 600.
On 20.000. Fair on 40.000 Pot if =

61 Hydrate Potassa (Caustic Potash)
R. Low. P. Best on all but Plat. Apparently
No Pol. on Hy. Pol. Slowly on Nickel
Best On Ox. Pol. Distinctly on all
but Plat On Ox. Diff on 20.000
Strong Diff. On 40.000.

62 Sulphate Zinc. R. Low. P. Ox Feebly on all -
Ox On all - Dif Nil -

63 Common Alum. R. Low. P. Ox Slow on Plat
Best on others. Ox Slow on Plat Best on others
Diff. None on 20.000

65. Chromic Acid. R. Low. P.Nt Just on all — Ox — Slowly on Brass - More on Iron Just on other. Diff. Nil on 20000.

66. Tartrate Soda - R. Low P.Nt Just on Plat. Just on others & very decided. Almost insoluble. Ox. Acces. Just. Diff. Strong on 600 Just on 20000 others.

67. Tartric Acid - R. Enormous. Thought freely diffused P. Nt Just Ox Just. R. Varies according to the Metal Independent of Poly. Diff Just plain on 20000

68. Ferro-Cyanide Potassa. R. Very Low. Poly. Nt Variable Least on Plat. On Ox. Just on all - Diff None -

69. Hypo Sulphate Soda - R Low - Varies with Ever Metal Independent of P. Least on Plat. P.Nt Just on all but Plat none at it - Ox R. Much Low. on all - P. Slowly on all Diff. 20000 Just it -

70. Carbonate Magnesia - R. Mod High Varies with Ev Metal. Plat lowest - Potter absolute Insoluble P.Ox Same Result - Diff Very strong on 20000 Just strong on 40.000 Best on Silver & Copper Fair on Plat. Others Nothing

71. Nitrate of Ammonia R. Low. P.Nt Just on all - Ox. Ditto - Diff Nil. —

72. Licorice - R. Low. P.Nt Just on all but Pt None on it - Ox - Just on all - Diff Strong On 20000 (very) Just it on 40.000 Diff - 600 other Just on Ox -

73. Citric Acid - R. Slow & Variable Mod. Low On Plat. Very high on Aluminum Tin & Nickel —

P.Nt Just on all but Plat. Ox On all - Diff Cant feel it on 20000 -

74. Arsenate of Quinine R. Low - P.Nt Just on all - Ox on all - Diff Just on 20000

75. Nitrate of Uranium R. Low. P.Nt Slowly on all Ox. None = Diff Just it 20.000

76. Valerianate of Ammonia R. Mod. P.Nt Just very on all - Ox Same Diff fair on Plat 20000 & Diff as strong on 40000 on Copper Less on Ox.

77. Valerianate Mag. R. Variable according to Metal Least on Plat. P.Nt Just on all - Ox on all Rec Fritchin Diff Cant Just it on 20000

78. Citrate of Quinine R. Very High - P.Nt Enormous Just on all - Ox Ditto but less decided - Diff Nil.

79. Valerianate of Soda - R. Variable High Least on Plat. P.Nt Just. on all - Ox Ditto. Diff. Enormous on 600. Strong on 20.000 Just as strong on 40.000 Phenomenon Diff On Ox. - On 600 other

80. Sulphate of Soda - R. Low. P.Nt Quick - Ox Just. Plat. Silver & Copper - Slower on Nickel Aluminum & Zinc - Slowest of Iron Lower on last 3. Diff On 600 Big On 20000 Strong. Best on Last Summer Metals - on 40.000 Not much Whatever On 600 other Slight Diff on all —

81. Hippuric Acid - R. Low. Variable - P.Nt Just. Ox Ditto Diff - 600 Good -

20000 Gk Strong Beat on nickel Weak
On Plat. 40000 Gk in Plain

81 Bromide of Sodium Rec. Very Low - Pkt off
None except on Silver. Ox Gk
None except on Silver. Dif on 600 Strong
20000 Dark Gk in -

82 Arsenate Soda - Res. Mod High. Variable
Pkt Very Dark. Mass on Plat. Ox
Dark - Mass on Plat. Dif on 600
Enormous on Plat. Slips on Ox. Very Strong
On 20000 Gk Strong on 40.000 -

83. Caffein - Res. Mod. Pkt Dark.
Too Dry to work -
Gk for Wright -
August. 25th 1876

84 Acetate of Mercury & Cauric Potash Trial 2
Rec. Low Pkt P. Variable - Tin Slow - Copper Slow -
Silver Quick - Ox P. Dark on all. Inc Fric
Slightly On Ox. D. Strong on 20000 Ditto
On 40.000
Same Strip quite Dry Pkt Polarizing on all
Platin - Very slow. Aluminium Quick
Ox. Dark on all. D. 20.000 Very Strong
On 40000 Ex. Strong -
H

85. = Arsenate of Soda - R. Low. P. Pkt Rather Slow
Especially on silver - None on Platinum
Ox Gk on all - Dif 600 Big - 20.000 Strong
40000 Pretty good

86. Iodide of Quinine R. Low Mod. Pkt Very Strong
Gk on all Dark on Plat Silver & Copper Ox Ditto
600 slips slightly on Ox - Dif. Pkt Comb.
Very Strong Nothing on 20.000 Ohm

86 Margarate Soda - R Low Pkt Just on all
Except Plat off none -
Platinum - Ox Very slowly on all - Strong Comb. to
Big. Just. Except on Plat.
Dif Nothing on 20.000 -

87. Sulphate Cobalt A Very High, Pkt Gk on all
Just on Plat. Ox Slowly on all -
Dif. Nil.

88. Acetate of Silver R. Low Pkt Gk. on all but
Plat slow - Ox Gk on all but Silver
Apparently none - Dif 20.000 Not in

89. Cyanide of Mercury - R High -
Pkt Gk on all - Ox slow mainly -
Dif 20.000 Nil.

90. Acetate Aluminia Rec. Low. Pkt Gk Quick on all
& same & Aluminium much stronger Comm
Very Strong at moment of Closing - Dif 20.000 Nil
Gk. Sulphate Quinine Rec. Very High - Pkt Enormous
Ox Ditto Dif. 20.000 Nil.

92. Carbonate Lithium Rec. Low. Pkt Gk on all
but Plat - Very Slow - Ox Gk on all -
Dif 600 Slips on Ox slightly on Pkt 600
Enormous - 20.000 Very Strong 40.000 Very
Ox Strong -

93. Caffein - Rec Mod Low. Pkt Just on all
Ex. on Silver - Ox Ditto on all - Dif Nil -

94. Carbazotic Acid. Rec Mod. Low.
Pkt Just on all. Ox. on all after Still -
Dif Nil on 20.000

95. Amygdaline Rec. High Variable Pkt Just on all
Ox None Slowly on all Except Silver Just
Dif 600 20000 Nil -

96. Acetate Morphine Rec Low Variable Pkt
Just on all - Ox Ditto Dif - Nil

97. Tartrate Manganese. R High P. Ply, Dust, O. all
Ox. Dilte D. f. Nil –

98 Citrate Coffein R High Variable Pl^y Dust on
all except Platin. Very slow – Ox. Slower
On all Platin. about 3 mins – Dif Nil

99 Chloride Copper – R Low Pl^y Dust. Ox^t
Ox Dilte D. Nil.

100 Tannate Iron R. Mod. Pl^t gl^t on all – Ox^t Slower.
Dif Nothing on 20.000 Ohms.

101 Hypo Phosphate Manganese Rec. Low.
Pl^t Slowly on all Ox dif Dif Nil.
Gives Black ppt Pl^t Oxidizes dight Brown on Ohms

102. Oxin – R. Very High Pl^t Fast on Plat. Gl^t on Copper
Silver Ox Starch any Except on Silver
& Copper – Dif Nil –
Gives Yellow ppt on A. Mostly Out on O – Dif
103 Valerianate of Quinine R. Very High Mixing
Rec. Even. Pl^t Dust. Ox Much Slower
Except on Silver & Copper. Dif Nil

104 Camphoric acid. Sl High Mr High on all but
Tin Plat. Zinc. Pl^t gl^t. Ox Very Slow. Ec
On Platin gl^t. Dif 2 mins Fast if on Silver
On 600 – quite much Silver Black –
4000 Fast if on Silver –

105. Sulphate Indigo Sl Low. Mr Even Pl^t Dust. Ox Slow.
Dif – 20 mins Fast if –

106. Hydro Bromat Ammonia Sl Very Low Mr Even – Pl^t Dust.
Ox Slow. On 600 Strong 20000 Nil
Gives Bromine ppt on Ox. Golden yellow.

107 – Manganate Potash. Sl Low Mr Very Low Pl^t Dust
On all Ex Platin None on Ox – R. Dust,
Aluminium & Nickel Slower on Tin 2 Mins on Platin Dif Nil

108 – Stannate Soda Sl Low. Mr Variable High on all but Platin –
Very Variable Dif. Not Being Lower – Ox Same result.
Pl^t Fast on all except Platin – Very Slow. Ox Faster Gl^t on
All. Dif On 600. Tremendous When Point of Plat
Platin is used. Very Strong on 40000

109 Creosote Sl Very High Mr Even. Pl^t Dust. On all Except
Platin – Slow – Ox. Very Slow; Dif. 20.000 Nil

110 Oxalate Carbonate Soda. Sl Low. Mr Variable. Aluminium
High ~~Nickel~~ Nickel Low Tin & Platin Low. Copper
High. Pl^t ~~Fast~~ on all Varying Deg. Slower. Very
Slow on Plat.
Phenomenon. Plat Poly in 1 Min. then often a
Momentary Opening Recovers – Pl^t Slow
Same Phenomenon on Plat. No Dif
Ox Dif on Ox Enormous Dif on Ag.
Very Strong On 20000 Quite Strong on 40.000.
Points of Plat Platin Makes great Delicacy –

111 Acetate Iron. Sl Mod. High. Mr Covered on Zinc Pl^t Dust.
Ox Dilte. D. Inc fig. on A. D. Nil On 20 000

112 Oxalate Ammonia Sl Medium Mr Variable High Fast on Aluminium
Pl^t & gl^t Ox gl.
Yellow Paper White ppt on Ag all Except Silver
Black – Dif Nil.

113 Sulphate Aluminia Sl Most High Mr Nearly Even.
Pl^t Dust Ox Generally – Platin Enormous Dif 20.000 Ox^t

114. Permanganate Potash. Sl Low. Mr Variable Slow on Platin – Pl^t Dust on
All Except (Slight Slow) Ox. gl^t on all. Ox Dif.
Dif Strong only on Aluminium Ox 40.000 feel if only
Ox^t Aluminium – Quite Strong.

115. Tungstate Ammonia. Sl Very High Mr Even Pl^t Dust. on
All Except Platin Slow Work. Mod gl^t on all –
Dif Nil On 20.000

116. Oxalate Quinine. R. Very High H. Lowest — Platina Richly on Aluminium P. gk On all but Zinc & Plat. Plat. Lowest. O. gk on all but Plat. — Moderately slow — Dif Nil on 20,000

117. Oxalate Magnesia. R. Mod Low. H. Lowest on Platina P. gk. O. Mod. gk. D. Nil on 20000

118. Lupulin. R. High H. Highest on Alumin — Lowest — Zinc Very Low } P. gk On all of Sec Plates — Mod. gk. O. Nil for gk — Dif Very Quick 20000. No obs — Nil.

119. Valerianate Zinc. R. Low. H. Variously Zinc High Slightly } P. gk On all — O. more slowly, Other Sub. Plat. Nearly Del Slips on O. Dif Low Big 20000 Mil.

120 Chloride Cobalt. R. Low H. Eve. P. Variable gk on Zinc Silver & Copper — Others Forming, Flat off more — O. gk. None on many. Dif 600. Great. Notice that by rubbing Paper gently with Hot Platina — Dif is more marked —

Notice that at Moment of opening Normal Friction of Paper is greatly Increased — on 20,000 No Dif.

121. Tannate of Quinine. R. High H. Eve. P. gk. O. None — Silver None — Big Sec of Rs in Paper When on Glass & O. — Very Orange Dif 600 Nil Except on Silver — weak

122. Borate Baryta. R. High H. Eve. P. gk On all but Plat & Glass — Least — O. gk. Dif Nil ok on 600.

123. Picrotoxin. R. Mod Low. H. Variously P. gk On all Dif Nil

124. Carmine. R. High H. — P. Dech. P. Slower Bleaches Color on O. D. Nil.

125 Prot. Acetate Copper. R. Low R. Platina Low. Aluminium High P. Dech. P. Ditto Dif O.

126 Nitro Prusside Soda. R. Low O. Platina Low. Tin Next Aluminium High. P. Dech. Sec Platina — Slow P. Not Quite so rapid D. Fric Inc. on O. — Nearly Noticeable on 600.

127 Iodide Iron. R. High H. Eve P. gk — & Platina — & Slow — P. & Slow on all — D. Nil on 600 Obs.

128 Sulphate Cerium Normal Friction of Paper Sec Small — R. High R. Eve — P. Dech. Exp on Silver. P. Ditto Friction Enormous on O. when Dried Tried & Moistened Nil on K.

129. Acetate Strontia R. Low R. Aluminium High Platina Low P. Quick for. P. Little Faster D. on 600 Slips Strongly on O. But little more on K. Nil on Zinc

130. Iodide Calcium R. Low R. Eve. P. gk on all Sec Silver & Copper — Dech on these — P. app. None Sec On Silver & Copper — Slowly — D. Nil on 20,000

131 Cyanide of Silver R. High R. Platina Low. Aluminium High P. Dech. P. Ditto D. 600 My Strong Zinc Tin & Platy Nothing at all on Alum. Weak on Glass Weaker on Copper — D. Nil. On 20,000 Obs.

132. Orpiment Barium R. High R. Zinc & Plat Low. Alum. High. P. gk. P. Ditto D. 600 Great Sec of Fric on Aluminium Mind Neg. on others. Necessary to Freeze Paint over the Paper

133

Sulphate Vinali Soda R^d Low. R^a Low. R^a Low Platin. R^a High Aluminum
P^d Es slow. None on Platin. P^d Very slow. but
(Rev. of Paper On Alum. High on R. Very Low on O.)
– Mod. gk on Platin – reserve upon opinion
Dif Fair on 20000

134

Acetate of Nickel R^d Low. R^a Nickel R^a – Paper adhere
P^d gk on all. P^a Sat. D. too Toxic
Sec. Enormously – Slips slightly on O –
D. Not good on 20000 –

135.

Sulphocyanide of Potassium } R^d Low. R^a But Low Tonic High P^d None on Alum
Sat on Nickel Slow on Zinc Slow on Tin None on
Plat. Sat on Silver Very Quick on Copper Slow on
Lead. P^d None on Alum – None on Nickel
& the Other Metals. D. too strong 20000 fair
Gives a Red Mark On Ox –

136.

Iodide } R^d Very Low. R^a High Alum. Slow Copper & Lead.
Low on Platin. P^d Sat. On all but Platin
Aff. None – P^a Slow Aluminum Slow on
Nickel Zinc Tin Platin – gk on Silver
(Rev. of Paper gk) – Quick On Copper – D. on Low.
Very strong 20000 Get it –

137.

Chloride of Aluminum } R^d Low. R^a Low Platin. High Aluminum P^d Sat.
P^a Sat on all – D. too very strong Not fair Test
138

Cyanide Barium } R^d Low. R^a Low Platin. High Alum (Enormous) P^d Sat
P^a gk on Alum Nickel Zinc. Slow on Tin
Mod on Platin Little faint Copper Very slow
On Lead. Slips slightly On Ox. D. on too
Quite strong, Not On 20000

138

Sulphate of Aluminum R^d Low R^a Enor. P^d gk on alum. Very slow on
Nickel or Zinc D. Tin None on Platin Sensibly any
On Silver gk on Copper & Lead – P^a Above
Alum. Nickel Zinc Tin on Platin Slow Platin. gk on Silver. Copper & Lead
Lead – Bad on Ox.

Diff on too great. A 20000 slight on aluminum
Nickel & Copper —

139.

Hypo Phosphate of Quinine } R^d Mod Low R^a High Alum. Low Platin. P^d R^a Dif Det the tin
P^a Enormous. Scarcely any passing thro. Alum. White
heavy Current passes through Platin. – P^d Sat.
On all – P^a gk on all – Sec. Toxic on O.
D. on too. Good. 20000 pitch fell 40000
Still fell.

#

140

Sulphite of Coppers } R^d Mod low. R^a High Alum low lead others Enorm –
P^a Speak slow on Platin – slow on others P^a Sat. on Alum
Nickel Zinc Tin Platin. Weaker but Sat on Silver
Copper & Lead – D. Too great on 600. Strong on 20000 & 40000
Sec. Fraction on O.

141

Cyanide of Potassium } R^d Very low. R^a Low Platin. High Alum, Zinc.
P^a Sat on Alum. Nickel Zinc Tin. & Slow Wood on Tin
Sat on Silver Copper & Lead. P^a Sat on Alum
Nickel Zinc Tin Slow on Platin Sat on Silver
Copper & Lead. Slight slip on Ox.
D. Big on 600, Good to get on 20000

142

Bi Sulphite of Soda } R^d Hyp R^a Low. Plat. P^d Slow on Alum. Nickel Zinc Tin
P^a Slow on Platin. Same so Silver Sat. on Copper.
Never under change in adjustment of Relay
Which gave above result – not proper Test – go
back to original adjustment as New as a
P^a Alum gk Zinc slow Tin slow. Nickel Very Slow Platin Slow
Copper none. Lead very slow. D. too Enormous Not on O.
D. Not get it on 20.000 –

143.

Pro. Chloride of Tin } R^d Low. (Paper very heavy up) R^a Variable
P^a – P^a gk on all – Phenomenon. P^a gk on all
Silver Plate Not very gk goes into earnest & [illegible]
Resistance Moves to fresh spot reserve Polarization
Gives Black Mark – which means apparently Enormous Conductivity
D. Not on 20000 Normal Fric. of Paper. D. Greater – [illegible]

144

Chloride of Cadmium { R^d Low. R^th Even. P^th Show on Alum. Nickel Zinc Very Show Tin. P^d Show show Tin Platina Silver Copper Lead – Show Black Mottled O. Nonacid Fresh great strength Decreasing fries. On O. D. Strong on Coo. Nil on 20000 –

145.

Sulphate of Ammonia { R^d Low R^th Lower Tin Platina High on Alum. P^th Just on Alum Nickel Zinc Tin Platina Silver Very Copper Do. Lead Show P^d Show Alum Nickel. Hy Zinc. gk Tin Just Platina Show Silver gk Copper. Show Lead – Nothing On Dy. D. weak on Coo Nil on 20000 –

146.

Benzoic Acid { R^d Mod Low. R^th Very High on Alum. Silver Low Zinc Tin & Platina P^th Just on Alum Nickel Show Zinc. Tin Platin. Just Silver Copper & Lead. P^d gk Alum Nickel Zinc Quantity show on Tin. Show Platina gk Silver Copper Show on Lead – D. Nothing on O. – A. Strong on Coo Strong on 20000 about as strong on 40000

147.

Sulphate of Morphia { R^d Low. R^th Low Platina High Alum. P^th Just Alum Nickel Zinc Tin Platina Silver Copper & Lead – Just recover P^d Just Alum Nickel Zinc Tin Platin – Show on Silver Just Copper Lead. D. Nil on O. Very strong on A. on Platina Silver & Copper on Coo. Fair on 20000

148

Acetate of Lead { R^d Low. R^th Pretty Even. P^th Just Alum. Show Nickel Just Zinc Show Tin Very Show Platina Black Mottled Apparently Mottled. Just on Silver Show on Copper –

Rheum By putting point of Flat Pen lightly on Lead – the Platinum diminishes allowing Current to pass Very Black mark left – This decreases in res. & very marked P^th Just Alum. Do Nickel Zinc Tin Platina Apparently Work on Lead – Act Arrangements – D. Paper rough. Nothing on O. A. Quite strong on Coo. Can't feel on 20000

149

Cornine { R^d Mod. Low. R^th Low Nickel & Copper – P^th gk on Alum Just Nickel Zinc Tin Platina Silver Copper. Lead. P^d Show on Alum. Nickel gk Zinc Tin Platina Silver Very Show on Copper Show on Lead – D^y Nothing A^th Strong on Platina on Coo. Ohms Campick feel it on 20000 ohms –

150

Sulphate of Ammonia { R^d Low R^th Low on all but Alum. P^th Just Alum Nickel Zinc Tin Platina Silver Copper Lead. P^d Just on Alum Nickel Zinc Tin Platina Silver Copper Show Cleanest & Sharpest Polarization Just noticed D^y Nothing Normal Fric growth – D^th Very weak on Coo. Nil on 20000

151

Sulphate of Strychnia { R^d Low. R^th Lowest Zinc Highest Silver P^th Show Alum. gk Nickel quite Low Zinc Just Tin Platina Extra Just on Silver. Just on Copper & Lead. P^d Just on Alum Nickel Zinc Tin Platina Silver Copper & Lead D^y Nil. D^th weak on Coo. Nothing on 20000 –

152

Chloride of Strontia { R^d Low. R^th Marks Even. Alum. High if any – P^th Show On Alum. gk on Nickel Zinc Hy. on Tin – Slower On Platina Just on Silver Copper & Lead. P^d Very show on Alum. gk Nice on Nickel Show on Zinc Tin Platina Silver Copper & Lead D^y Slight Slip – D^th Very strong on Coo. Nil on 20000

153

Chloride of Magnesia { R^d Low R^th Alum High. Low Platina Sil. & Cop. P^th Just Alum Nickel Zinc Tin Silver Copper & Lead P^d Just Do Do & Do Show Very fast Quick D^y Slips On A Slightly D^th Hardly any On Coo Nothing on 20000 Grey Brown Mark on Hy

154. Fluoride of Sodium #

Rd Low. Rm about Same
Pd Gh Alum. Nickel Zinc Tin Platinum Just & very great Effer Dy
Po Slow " " " " " Silver Gh Copper Lead
Do Slip quite strong on Platinum Faint on Others
Dd Effer Great on Coo. Quite strong on 20.000
Equally strong on all on 40.000
Normal Price of Paper appears to be quite great passing over silver — Silver See Tris on O. through 40.000 quite plain - Also on Lead probably Platinum Also notice it on Zinc & thick & increases on N. on Lead thro 40.000 But much weaker than on O.

155. Nitrate of Zinc -

Rd High. Rm Slight Difference
Pd Just. Alum Nickel Zinc Tin Platinum Silver Copper Lead -
Po " " " " " " " "
Do Slips slightly on all Except plus - Eff. Dec. Friction -
Dd Strong on Coo Nil on 20.000

156. Baptisia

Rd Mod. Rm Low Copper Zinc High Alum.
Pd Just. Alum. Nickel Zinc Tin Platinum Silver Copper Lead
Po " " " " " " " "
Do Imperfect Friction -
Dd Coo Rather weak. 20000 Platinum Slightly

#

157. Sesquic Chloride Cromium

Rd High. Rm Low Platinum High Alum & Lead. Dif Very Marked.
Note Band Pass across Platinum with Velocity & Closes Below Clear & Sharp. Extraordinary
Note Paper gets Dry quite rapidly
Pd Just. Alum. Nickel Tin Wood Current & Bridge Do Zinc Slowly on Tin Just on Platinum Silver - Copper Doubtful Do Lead.

Dried up

158 Benzoate Soda - #

Rd Extr Variable. Rm Very High on Copper & Alum Ec. Low On Plat. Greatest Dif yet noticed but not sharp like No 157 =
Pd Extraordinary Instantaneous Almost Insulation on all Except Platinum - Note what ever on it. As Paper Dries it gives Sharper action as in 157.
Po Quick Alum. Nickel Zinc Platinum Copper Silver & Lead.
Do Inc Friction
Dd Very great on Tin & Platinum - Fair on 40000 Quite strong on 20000

159. Bi: Chloride Mercury

Rd Low Rm Alum High Platinum Low. Sharp closing in from Rd
Pd Just on Alum. Nickel Zinc Tin Platinum Silver Copper Lead
Po " " " " " " Slow " Slow " Up "
Do Nothing
Dd Great on Coo. Quite strong on Alum & Nickel on 20000 Fair on 40000 Nickel

160. Salicine #

Rd Low. Rm Even on all but Alum. High.
Pd Just. A. N. Z. T. P. S. C. L
Po " " " " " " " "
Do Nil.
Dd Great on Coo. Quite strong on 20000 on Zinc Equally on 40000 on Zinc. Platinum not as good as Zinc -

161. Pyro. Phosphate Soda

Rd Very low. Rm Rather Even High on N. & A.
Pd Just on A. N. Z. T. Little Slower on P. Ok on S. Just on C. & L
Po Quick on All -
Do Nothing Dd Ex. Strong on Coo. Good on 20.000 Rather weak on 40.000 —

162. Phosphate of Calcium

Rd Low. Rm Lowest on P. Z. & T. High on L
Pd Just on A. N. Z. T. P. S. C. & L
Po " " A. N. Z. T. P. S. C. & L
Do Nothing. Dd Mod. on Coo. Nil on 20.000

163 Tartrate Iron

R^d very Low. R^m Even.
P^t Inst. A. N. Z. T. P. S. C. L.
P^o " " " " " " "
S^o Nothing. St Aff. Inactivity on Coo. Weak - but grow
Now shows Dif on O. Cant say if Inc or Dec.

164 Benzoate Ammonia

R^d Low. R^m Even. Low on Platina.
P^t Inst. A. N. Z. T. P. S. C. & L.
P^o " " " " " " " "
S^o Alps Slightly. St Gelts weak on Coo Nil on 20.000.

165 Carbonate Ammonia

R^d High. R^m Even
P^t Inst. A. N. Z. T. P. S. C. & L.
P^o OK " " " " " " "
S^o Ex. Spring Fric. at moment of closing. Insuch. Coos.
St Very Weak on Coo. Nil on 20.000

166. Sulphate Carbolic Lime

R^d very High. R^m about Even
P^t Inst. A. N. Z. T. P. S. C & L
P^o OK
S^o Inc. Slightly. St Hard to detect on Coo.

167. Chloride Barium

R^d Low. R^m Even
P^t Gt slow A. N. Z. Tolerable T. Slow Sph. Coo L Da
P^o " " " N. Bar - Z. Same Tsame Psame Sph. C. Slow Sph. Slow
S^o. Cant define action - St Mod. spring on Coo. Mod. 20.000 on Z. Inc.

168. Nitrate Uranium & Potash

R^d Low. R^m Ex. Variable Platina low.
P^t Gt on A. N. Z. T. Not a P. Gt B. Paper Dry on Copper & Lead
P^o Inst. " " " "
S^o Gt spring Slip on O. S^t Gt. Nf on Coo. Gt it on 20.000

169. Chloride Lead

R^d Low. R^m Very Slight Dif
P^t Inst on A. N. Z. T. P. S. C. & L.
P^o " " " " " " " "
S^o Nil S^t Gt spring on Coo. Get it on 20.000.

170. Gallate of Ammonia

R^d Very Low. R^m High on A. & L. Low on P.
P^t Inst on A. N. Z. T. P. S. C. & L.
P^o " " " " Slow T gt P. Slow S. C. & L.
S^o Enormous Inc. & S^t Gt. Dif on Coo. Get it on 20. Barely in Slow.

171 Chloride Morphia

R^d Moderate R^m Short Closing on P. High on A.
P^t Inst on A. N. Z. T. P. S. C. & L. Last 3. Extra
P^o " " " " " " " "
S^o Nil - St Mod spring on Coo. Cant get it on 20.000

172 Lactate Iron -

R^d Rather High R^m High on A. Low on Z.
P^t Inst. on A. N. Z. T. P. S. C. & L
P^o " " " " " " "
S^o Slight - St Barely any on Coo.

173. Oxalate Potash

R^d very Low. R^m Platina Low. Copper Inverted - Dif well defined
P^t Inst on A. N. Z. T. Zero P. Inst S. C. Zero L
P^o Mag on " " "

Note. Noticeable Red. of Even on O. & the reduction of the C. Current in its passage through the solution upon use the Metals is much less than it is upon K. By turning off Spring of Relay Relay is detached through the gauge in Board in proportion to the current.

P^o Slow on A. N. Z. T. Slow P. S. C. & L.

Dry

Note To explain these peculiarities we wish to state that Polarization is not so well defined as when Spring is long Resistance through current & Cure only be collected by getting a

Higher adjustment of the Relay
Since the terms Gk. Slow. & Instantaneous are not absolute but simply
Determine the relative proportions
of Polarization upon that adjustment
& also tested to show any very decided
Difference - The absolute determination
of the Polarization can only be had
by Means of a Wheatstone Bridge -

174 Iodide Sodium

Rd Leg. Rm Leg Platina High silver
Pk Slowly on all
Po Moderately " " Do Inc. Dk Great on 600.
Quite strong on 20000 - Get it plain on 40000

175. Amonia Citrate

Rd Very low. Rm Lead High.
Pk Gk On all. Do Cant define action
Po " " " Dk Dont feel Inc on 20,000

176. Acetate of Zinc

Rd Low. Rm High Al. Low Tin.
Pk Slow on all But C & L. odd. none on Tin
Po. on A. almost from Zero to Absolute Insulation.
- Slow on N. very slow on Z. gk on T. P. S. Slow on C. & L.
Had to turn up adjust to show it on last H
Do Decreases Dk None on 600 ohms -

177. Bisulphate Soda.

Rd Low - Rm Low on P. High on A.
Pk Mod Slow on all But lead (Spring High) None
Po Slight A. N. Slow T. T. P. Po. S. None Copper & L.
Do Cant Do it. Dk Slight on 600. Nil on 20,000

178. Citrate Magnesia

Rd Quite High. Rm Low.
Pk gk on A. N. Z. T. P. S. C. & L
Po Slow - A. N. Z. T. P. S. C. & Very on L.
Do Nothing Dk Slight on 600. Nil on 20,000

179. Acetate Magnesia

Rd Low. Rm High on A. Low on P.
Pk gk on all Ro Count Define it
Po " " " Dk. Very light on 600. Nil on 20,000

180. Chlorate Soda.

Rd Low. Rm Even.
Pk Slight on A. N. Z. T. P. Dest. S. Slow on C. & L.
Po Very " " " Barely any on N. Slow on Z. T. Extremely slight on P.
Do Nothing Dk Great on 600. Fair on 20,000

Quit for Tonight - E. Hoskin -

- 4 AM Aug 26th 1876 -

181 Borat of Copper

Rd Low. Rm High on A. & L. Rich Low.
Pk Slow on A. N. Z. T. gk & P. Slow S. gk C. & L
Po " " gk N. Z. T. Dest P. S. Slow C. gk L.
Do Nil - " Dk Mod. on 600. Detect it on 20,000 on S. only -

182. Chromate Potash

Rd Low. Rm Even
Pk None on A. N. Slow Z. None T. P. Dest S. None So C. None L.
Po " " " " Z. T. P. Vy slow S. C. L.
Do Quite Slippery Dk Strong On 600. Nil on 20,000

183. Tartrate Magnesia

Rd High. Rm Lowest On L & P. High on A. & L.
Pk gk On A. N. Z. T. P. S. C. L.
Po " " " Dest N. Z. T. P. S. C. L.
Do Dont know. Dk Strong on 600 - Get it on 20,000
Probably on 40,000

184. Magnesate Sodium

Rl Low. Rm Rather Abnm. High on A. & L. Low on others
Ph Slow on A. gk on N. L. T. None on P. Stores on S. Best C. L.
Po Very " " A. N. L. T. P. S. C. L.
Dc Inc. Strength. Dh Strong On 600 Nil On 20,000

185. Phosphate Lime

Rl High Very Rm Too High to find Variation
Ph gk on A. Best N. L. T. & slow & slight on P. S. gk on C. Best L.
Pc Slow on A. N. L. T. Best P. S. C. & slow on L.
Dc Slight change of some Sorts. Dh Meat on 600. Quite Plain On Nilon On 20,000 Nil On 40,000

186. Acetate of Lime #

Rl Low. Rm High on A. L. S. & L. Low on P. & C.
Ph Slow on A. M. L. gk T. Best P. Very Best on S. Best C. L.
Po gk on A. N. Best L. T. Slow on P. gk S. Best C. L.
Dc Slips Strong. Dh Quite Strong on 600, Strong on 20,000 Quite Strong On 40,000

187. Acetate Cobalt -

Rl Low. Rm High on A. Low on Others -
Ph gk on A. N. L. T. P. S. C. & L.
Po " " " " " " " "
Dc Feel something. Dh Nothing -

Aug 30/76

188 Sulphate of Aniline

Rl Low. Rm Pretty Even
Ph gk on all Dc Nil On 600
Po gk on all Dh Good on 600 Nil on 20,000
Violet Mark On O. Quite sensitive On 600 Mod. on 20,000

189. Salicylic Acid

Rl Very High. Rm High on A. Best L. Best T. Best L. - Low on Others T. Low
Ph Ok on all Po Ok on all.
Dc Inc. Tric Strongly On P. S. & C. Others weaker -
Dh Meat on 600 Nil On 20,000

190 Hypo Phosphate of Ammonia #

Rl Very Low. Rm Nearly even. High on A. Low on T.
Ph Mt. Slow on P. gk S. Others rather gk. Except Slow Mrs. Nor. Best.
Po Very slowly on all - Dc Slips. Dh Inc Tric on 600. Nil On 20,000
Action on Silver Very quick - Sometimes insulates itself - makes Sots - on Plates
Small chips of Phosphorus & ammonia -

191 Prot. Iodide of Iron -

Rl Mod. High Rm High on L. Very High on A. Low on Others Platina Low each.
Ph Best. On all. Po gk on all. Platina Best. Dc Slips. Dh Strong on Low Very on Average only. Fail to Mark

192. Iodide of Barium

Rl Mod. High. Rm Even.
Ph Ok slow on but S. C. L. gk on these -
Po Slow on all. Thermom. Dark weak on, gradually as in Other Potassiums but Makes 4 sots full Strength, then Cease abruptly -
Dc Nil. Dh Very small on 600. Get something On 20,000 Gives Iodine mark on O. Bleached out on Ny.

193 Nitrate of Lime

Rl Very High. Rm Rather Even
Ph gk on all. Po Ditto. Dc Slips Dh Meat on 600 Nil on 20,000

194. Oxalic Acid #

Rl Very High Rm Too High & Tech.
Ph Too High & get Tolerinyhlin Po Ditto
Dc Inc Tric Enormously.
Dh Very Strong Strength 40,000 } Book these on O.
Dc Inc Tric on 600 weak. No weaker on 40,000

195. Mannite

Rl Very High Rm Quite weak Cant tell
Ph Quick. Po Variable Too weak to Get Definite Tech.
Dc Nil. Dh Meat on 600. Get it On 20,000

196. Valerianate of Morphine

Rl Ex High. Rm Even as far as can tell
Ph Ok. Too weak to detect. Dc Slips Strongly on 600. Don't Get
Dh Slips Rather Dif on 600 Nil On 20,000

197. Glycos col.

Rd Very High. Rm Tro High to Detect
Pk Tro High to Iron Poly. Dilto on Po +
Do Slip. Spring on 600 Nil on 20000 Dilto on N.

198. Arsenic Hydrate

Rd Very High Rm Cant give Charges
Pk Po Cant bring the charges
Do Nil. Dk Nil on N.

199. Chloride of Magnesium

Rd Very High Rm Cant give it = Lots P. High on A.
Pk Very quick on A + L. gk on T. Others Mark Nil.
Do Dash felt something Dk Spring on 600 Nil on 20.000.

200. Sulphuret of Baldium

Rd Mod. Low. Rm Vy High on A.N. Low L. High T. Vy low T. S. C. + L.
Pk Dash on all. Po Slow on all but S. + G. Dm Same as Vy slow on L.
Do See on A. + Z. T. Dc. On others (apparently)
Dk Very weak on 600. Nil on 20.000

201 Asperagin.

Rd Mod. Rm High on A. L. Low on others
Pk Vy Dash on all Exp Plating
Po Slower - Do Nil. Dk Felt it on 600.

202. Chloride of Zinc #

Rd Ex Low. Rm Even.
Pk Slow, Nil full, Current up to point of abrupt Plating stop
Po - Same thing On A. N. Much slower on Z. T. Vy gk on T. S. C. L.
I believe the slower Odor noticed in Phosphate + this is due entirely to Oxyne. Do 30 - 1 is Vy strong
Do + Dk Nil - The Oxyne reaction is strong on P. + S.
Oxyne makes a Reddish Nil on O. which shades —

203. Phosphomolybdenic acid

Rd Mod. Low. Rm low on T. High on A. Other Pretty High
Pk abs. Dash. Po Slower a trifle. (One Dot on N. L. on O.)
Do Nil. Dk Ex Strong on 600. Normal Fric greatest it normal
Opening Fair on S. C. on 20000 Nil on 40000

204 Sulphate Bebasin

Rd Ex. High. Rm Lowest on S.
Pk gk On all. Dm
Po gk on A. N. Z. T. Dash on P. Slow on S. Much on C. L.
Do something Dk Very weak on 600. Nil on 20000

205. Bromide of Mercury.

Rd Low. Rm Very low on T. High on A. Mod. High on S. C. Low on T.
Pk Dash on A. N. Z. T. P. S. C. L
Po " " " " " " " "
Do Nil. Dk Ex Strong on 600. Barely felt it on 20.000

206. Iodide of Cadmium

Rd Very Low Rm High on A. N. L. low on others
Pk Ok on all But T. + S. Slow on these abrupt when it crosses
Po Dash on all Do Nil. Dk Nil Ex. on C. gk strong on 600 Nil on 20000

207 Nitrate of Lime

Rd Very low. Rm Even. Super addition to Plating
Pk Quick On all —
Po Gk none on A. N. Z. T. Nil on P. S. Slow on C. Slow on L.
Do Nil. Dk Weak on 600 Nil on 20,000

208. Anthracite of Potash #

Rd Low. Rm low on P. High on A. + L.
Pk Very slow on A. Just N. Z. T. Nil on P. gk on S. Dash on C. + L.
Po Quick on A. by stars N. Z. T. Slow T. S. C. L.
Do Gk slight Dc + Dk Ex Enormous. Reverse action + Dc
Fric very strong on 20,000 + other more marked on 40,000

209. Phosphate of Magnesia

Rd Mod High Rm High T in low P. Others Med.
Pk Dash. abs. Po nearly So —
Do Nothing Dk Ok strong on 600. Felt it on 40000. MK

210. Chloral Hydrate

Rd Mod Low. Rm High on A. N. T. Z. Vy low on P. Known MK on O.
Pk gk A N Z T Vy low P. gk S. C. L. Po gk A. Slow N. Z. gk T. P. Slow S. C.
Do Nothing Dk Weak on 600 Nil on 20,000 Oxyne gives

211. Lactic Acid

R^d Mod Low. R^m Nearly even. A high Flow
P^h gl on all but T. Show abright & variable -
P^o Flower on all. P. quite low.
S^o Nil. S^d Weak on 600 Nil on 20000 Sf. Bk Nil on N. Silver

212. Molybdaenic Acid.

R^d Quit. Low. R^m Even. P^h Abt. Such. P^o Pink & mauve.
S^o Nil. S^d Very weak on 600. Nil on 20000

213. Citronic Magnesia

R^d Vy. Low. R^m Like Low. High on A. N. & rather High on P. & other
P^h Not mall. P^o Not mall but S. & C. gl on Three S^o Sec. Tric.
S^d Strong on 600. Barely fail on 20,000

214. Pyro Lignous Acid

R^d Vy High. R^m Low Z. High Others
P^h Not on all no S. Shows the Sec. of Rec. on passage of current, and
an anonymous lower Polarization
P^o gl on all exc. L. Sec show on L.
S^o Nil. S^d Nil on 600 Nil sec. on L. Nil on 20000

215. Tartaric Acid.

R^d Mod low. R^m High on A. L. C. S. Low. P. Z. T.
P^h Not on all. Except S. Best Nearly Anonymous Poly
P^o gl on A. Show on Z. gl T. P. S. C. L.
S^o Nil. S^d Weak on 600. Barely any on 20,000

216 Sesquichloride Iron.

R^d Very low R^m low on all - slightly higher on A.
P^h Enormous Poly & Very Not. on all.
P^o Not on all Exc. S. C. L.
S^o Nil. Dif on Either Only

217. Disulphate of Copper -

R^d Low R^m Low on all but S. C. L. High -
P^h Great on all. P^o Show on A. N. Vy show Z. T. Not. P. gl on S. Not C. L.
S^o Nil. S^d Nil -
Poly is Enormous with Not & Pleasure. Platin Coated with Copper

218 Gum Tragacanth

R^d Mod Low. R^m High on L. C. Vy show on Z. & P. Gives 2 Dots on Showing
Over the Whole Pic
P^h gl on all - P^o Ditto
S^o Nil. S^d Vy strong on 600. Nil on 20,000

219 Arsenous acid.

R^d Low. R^m Low on P.
P^h Not. on all. P^o Not.
S^o Nil. S^d Very little on 600. Just fail it on 20,000

220. ~~Sulphurous~~ Palate of Ammonia

R^d Vy Low R^m low on N. & P. Makes 2 Dots in running the Mixture
P^h Not & Great. P^o Show A & N. Vy show Z. T. gl T. & show on S.
Not C. L. show L.
S^o Small. S^d Weak on 600. Just it on 20. Nearly as strong as
221 Gum. Dextrine

R^d Very High. R^m low on P.
P^h Not on all - P^o gl on A. N. Show on Z. gl T. P. Not S. C. Not
S^o Nil. S^d ~~gl~~ strong on 600. Fair on 20000 Ditto 40,000

222. Sulphuret of Calcium

R^d Low. R^m Fairly Even. P^h Poly mall. P^o Ritz gl A. N. Z. gl T. Not P. C.
S^d Strong on 600, Fair 20000 Just it on 40,000 Show -
S^o Nil

223 Sulphuret of Antimony

R^d Mod. High. R^m Lowest on S. Rather even -
P^h Not. Great. P^o Ditto Slightly Stronger.
S^o Nothing. S^d Mod strong on 600. Nil on 20,000

224. Nitrate of Lead.

R^d Very Low. R^m Even. P^h Very show & strong on A. N. Z. T. Not gives p. show on T. - On S. Sudden & acc
Announced by Dots at moment of Polarization. Same Phenom. on Copper & Lead
P^o Not on A. Rose on N. Vy Show on Z. T. P. & show on Glass. Copper & Lead
Black Mk. - Poly not sudden on O. S^o Nil. S^d Nil

225. Gum Guiac & Caustic Potash

R^d Low on T. High C. & Va. P^h Not. P^o Ditto
R^d Low S^o Nil. S^d Vy great on 600. quite strong on 20,000.
Equally so on 40,000

226. Caustic Soda Gum Gamboge

R^d Low. R^m High on A. N.
P^d Gd a v st. Bish. L. T. Nil P. Ty flow a. S. Bish. C. L.
P^o Gd A. N. L. T. T. S. C. L.
D^o Nil. D^t Enormous on 600. Strong on 20.000 & strong on 40...
Think it as good as Acetate of Mercury –

227. Gum Guiac #

R^d High – R^m Highest A.
P^d Bish on all. P^o Bish on all – Light Blue. Not as A.
D^o Nil. D^t Enormous on 600. Fish it strong (on Trial) on 20.000
Nearly as strong on 40.000 very fair –
Combine this with the Solutions giving the Orange Green – for Platina Solution. #

228 – Caustic Potash Gamboge –

R^d Ty Low. R^m Pretty Low – P^d Gd on all but P. slow.
Notice this paper being quite wet. You should cut on
1st closing – #
P^o abs. Bish. Ty. Great. D^o Enormous Inc. Fric –
D^t Ty Gd. on 600. Ty strong on 20.000 strong on 40.000

229. Caustic Soda – Paper Wet.

R^d – & Low. R^m
Paper So wet. Res. So low. Cant Detect Poles –
D^o Slips strongly D^t Not so great – as normal Fric
is low. Pretty good on 20.000 Very Faint on
40.000

230. Gum Guiac & Caustic Potash

R Very Low R^m Low on P. Nitro. o Sat.
P^d Best on all Ex^d P. little slower
P^o Bish on all. Inc Fric Greatly on A
D^t Enormous on 600. Gt strong on 20. & strong on 40.000

231. Glycerine

R^d Mid. High. R^m Low on P. High on A.
P^d Gd on all. P^o Ditto
D^o Nil. D^t Barely get it on 600

232. Gum Sulphur & Caustic Potash.

R^d Low. R^m High on S. A. Low. Z. P. & T.
P^d Best on all P^o Good.
D^o Inc Fric – D^t Fairly strong on 600. Just full it on 20.000

233. Balsam Copaiba & Caustic Soda –

R^d Low. R^m Variable hard to determine
P^d Best on all. P^o Ditto D^o Slips gt strong – D^t strong on 600.
Gt strong on 20.000 strong on 40.000

234. Balsam Copaiba & Caustic Potash

R^d Low. R^m Low on Z others most even –
P^d Best on all – P^o Ditto
D^o Slips on A. D^t Great on 600. Strong on 20. Nearly gt strong

235. Venice Turpentine Caustic Potash

R^d Low. R^m Low Z. High on A. & C.
P^d Best on all. P^o Ditto – D^t Slips. D^t strong 600. Fair on 20.000
Just get it on 40.000

236. Gum Senegal Caustic Potash

R^d Low. R^m Level on P. Nitro Sat on Paper
P^d Best. P^o Ditto. D^o Nil. D^t Ty strong on 600.
strong on 20.000 Just full it on 40.000

237. Gum Gamboge –

R^d Very Low. R^m Low as on Z.
P^d Best on all. P^o Slower on all –
D^o Nil. D^t Weak on 600. Fair on 20. Cant get 40.000

238. Gum Benzoin & Caustic Potash

R^d Ty Low. R^m Low on P. Most on Z. High on A.
P^d Best on all – It breaks quick
P^o Ditto. D^o Nil. D^t strong on 600 Fair on 20.000 Gt 40.000

239. Balsam Tolu & Caustic Potash

R^d Ty Low. R^m Low Flat Next Z. Highest on A. Next L & C.
P^d Best on all. P^o Ty Bish. Inc Fric. D^o Mod strong on 600
Just get it on 20.000

24

240 Gum Sandarac & Caustic Potash

R^d Yellow. R^m Low Pretty Even
P^h Dark on all P^o Ditto
D^o Mt. Fric Slight. D^n Big Eos Coo Gh if on 20,000

241. Gum Myrrh & Caustic Potash

R^d Low. R^m Low P. High.
P^h Dark on all P^o Ditto
D^o Nil D^n Gh. on Coo Dark gah if on 20,000

242 Balsam Peru. & Caustic Potash

R^d Yellow. R^m Low Flat
P^h Dark on all. P^o Ditto
D^o Slip. D^n Strong on Coo. Gh if on 20,000

243 Gum Tragacanth Caustic Potash

R^d Low. R^m Flat Low. C. High.
P^h Dark on all. P^o Ditto.
D^o Nil. D^n Gh on Coo. Dark fel 20,000

244. Balsam Canada & C.P.

R^d Yellow R^m Low or P. High on T.
P^h Dark on all. P^o Ditto
D^o Mt. Fric Slight. D^n Gh on Coo. Fair on 20,000 on P. Cant fel on Hooed

245. Balsam Tolu.

R^d almost Insulation. R^m Low P. High A.
P^h Dark on all. P^o Slower on all
D^o Nil. D^n Quite Strong on Coo. Gh if on Copper & Glass On 20,000

246 – Per Tartrate Potash.

R^d Low. R^m Lowest on P. Makes Dot on Resorcin
Reject on alum
P^h Dark & Gy. P^o Slightly Slower.
D^o Nil –
D^n Fair on Coo
Fair – P. Strong on S. on 20,000

247. Benzoic Acid –

R^d Ex High. – R^m Even –
P^h Dark on all. P^o Slower on all.
D^o Nil D^n Quite Strong on Coo. Gh Strong on 20,000
Cant fel if on Hooed

248. Caustic Soda Strip Quite Dry

R^d Low. R^m Lowest on P. High on A.
P^h No Color on P.
D^o Enormous. Ex Strong on 20,000.
Exp^t Strong on 240,000 1st Class Red Ox

This Fills the Bill
Aug. 30th 1876

A. Brown

Correction of Bradley Rheostat with BA Elliott Bros Standard Rheostat, Bridge with Speaking galvanometer Mirror, 3 feet from Scale, 1 cell Carbon battery,

R of Bradley all plug pendings

	Coil	Forward Dot by Ear by measure or plugs values indicated in opposite	ohms Fraction only	Out
	10		10	
	20		18	2
	30			
	40		O/K	
	100			
5 Cells Carbon	200			
	300			
	400			
	1000	995		5
	2000	1990.		10
	3000	2985		15
	3000	2965		35
	2 Wind with long & one	2958		67. equal 6 cells
		65		Whole. 20 cells

2 cells Carbon Test, Same –

Total 70
67
75
3)212
Mean 70

Walter Bradley Coil A No28

Accurate test to within 1 ohm on large resistance

Large Mirror, 20 cells Carbon Battery.

Has a resistance of from 4 & 5 ohms plugged up.

Correct within 1/10 of an ohm to 300 coil

	300 —	298.3
	400	399
	1000	996.7
	2000	1989
1st	3000	2990
2nd	3000	2998.1
	9,700.	
		9631.1
		9700.0
		0069.1 = .69.1

Seperate actual

Total taken together 9631. — 69.

when 10,000. in dif 73 showing 3.9 dif in bal of Coil. ~~m~~

The initial Resistance all plugged up is only a fraction of an ohm Aug 31 1876 TAE.

=

Sept. 1. with 20 grain acetate Cobalt 100 CC H2O. you can plate Cobalt nicely on platina 20 cells through 1000 ohms

Electro Motograph. Continued - Sept 4 1876.

Pending the construction of an Instrument designed to present a new surface to the friction point so as to avoid the Effects of Polarization - the tests found on the preceding Pages were made having in view the attainment of the same object in a different way - viz - by feeding a Solution having great frictional Difference with a minimum of Polarization

Of the Results of the latter; record will follow —

Of the result of the Constantly Changing Surface - that is to say - the Instrument with Chalk Cylinder & travelling Pen we have only to record as yet that it fails of its purpose —

We now go back to the Chalk Sticks & Matrix Paint - & find certain results say 200 words per Min. on 5000 ohms nearly always obtainable but not reliable

We find that it is not Resistance that is required - but friction Created by the Chemical Solution in which the chalk is steeped - so that when the Current passes & this friction is neutralized by it the Normal friction of the chalk alone is active - this latter by reason of the use of but slight tension on the Springs being slight - the retractile Spring is left free to operate with great promptness.

We now proceed to Experiment with this apparatus

Keeping Mr Israel Chalfs in the Collections recommending themselves as efficient in the properties we require Viz

Strong Normal Friction upon Open Current.

& Complete Neutralization of same upon passage of Current through it -

Our previous Notion has been that our Normal Friction was to be obtained by great pressure on the Point -

We now find this is wrong - That we must have a Normal friction generated by the Chemicals alone & the end that it may be neutralized by the Current - & the Retractile Spring have only to overcome the light pressure of the Spring we are by this means enabled to use -

1

Caustic Soda. 2 Gr. Balsam Canada 5 Gr. Caustic Potash 2 Gr. 100 cc H2O No good -

2

5 Gr. Balsam Copaiba 1 Gr Caustic Potash - 100 cc H2O No good -

3

5 Gr. Gum Guiac 5 Gr Caustic Potash 100 cc H2O No good -

4

Caustic Potash - Gamboge. Liquid Mixture of Iron 100 cc H2O No good

5

8 Gr. Bi. Carbonate Soda. 100 cc H2O. No good.

6.

You led off into general Experiments with the point of the pen Med it should stopped thus - but found Fluff would collect underneath it & destroy action - Turned the same point perfectly upright thus ¬ - Also failed - then fitted it to a position at right angles thus ⊢ so that it travelled Edgewise - this apparently works very well - but may be found less effective than a point

Med on these various points various solutions of Gamboge Caustic Soda & Caustic Potash - as follows

Saturated Solution of Caustic Soda & Gamboge

Strong Sol. Caustic Soda - Alcohol & Gamboge.

Caustic Soda & Glycerine

& C Getting very fair results But not at all satisfactory -

We tried placing a piece of paper upon the Check - & found good results. Immediately - following these up & trying the paper on a solution of Caustic Soda & Gamboge working by nice adjustments we got 250 words per min & Perfect on 36.000 ohms - Good -

11 am - Sept 6 1876 -

We find great difference in Paper - Some papers giving good results others failing to operate at all -

All with a solution of 5 gr Caustic Soda 5 gr Gum Gamboge } working

Best Paper - & this time 11.30 am J. F. Cushman & Co. Chemical Labels Pink Highly Glazed Surface

Works well at 2 & 300 per min on 36.000 ohms

Apparently no False Sets -

Local Ckt Breaker does not have the Nibbling vibration when Ckt Open or Closed -

Phenomenon

To a solution of Bisulph Carbon & Spirit Turpentine Iodine is added, after several days, perhaps 2 weeks, the solution becomes colorless, I have just added a large quantity of Iodine, Sept 9 1876.

Phenomenon. Caustic Potash left in a solution of Bisulphide of Carbon for two or three weeks liquefies to an intense yellow syrupy solution, which gives the purple color with nitro prusside of sodium & is probably Potassic Sulphide whether there is new compound sequestrated

Phenomenon:
Spirit Turpentine }
Bisulphide Carbon } to which is added Crystals of Iodide Potassium after several weeks considerable quantity of Iodide dissolved & portion decomposed into free Iodine which colors solution reddish,

when Iodide is added to Spt Turpentine after several weeks the solution is colored reddish with the appearance of a syrupy heavy solution at bottom when bottle shaken these separate in fine globules they adhere to sides bottle but liquid runs down in streaks -

Phenomenon

Alcohol + Bisulphide ~~of~~ Carbon + Caustic Potash after several weeks Exceedingly fine needles like crystals, collect on bottom & around sides in considerable quantity = Potash disappears = what substance is it

Phenomenon

Alcohol + Mono-chloro-acetic acid, after two or 3 weeks very small quantity of precipitate like crystals. Collect on bottom + alcohol acquires an ethereal smell also something like acetone. & whisky

Oil Mirbane + Oil Sweet almonds, permanently cloudy - slight yellowish tinge, sun appears red through solution appears to have great power of showing prismatic colors

Alcohol + Iodide Potassium after 4 weeks I find 3 or 4 prismatic like crystals large & transparent - just like Mica 1/4 inch square; whether this is a crystal of some substance or something that gathers the bottle deposit & crystallizes out

Iodine + Iodine - after 2 or 3 weeks Iodine apparently dissolved with a solution of liquid redish. due to the formation of a sticky gum or pasty which globules on shaking bottle,

Creosote + Bisulphide Carbon; perfect mixture I think that addition of Creosote may possibly increase the prismatic power of the Bisulphide Carbon

Bisulph + Glacial Acetic Acid, - acid on top Carbon below - peculiarity is that around threads of the bottle & on bottom there are drops which have the appearance of an ice pitcher on a warm day (?) outside, or supposing no liquid were in the bottle. Object as if it had been washed & not wiped out — probably due to ~~gas~~ gas,

Oil Rosemary + Caustic Potash, latter after several weeks liquefies to a reddish solution = what is this new derivative =,

Phenomenon -

Strips of Ivory soaked in oil of Mirbane for six weeks becomes transparent Hard Rubber 1/8 inch becomes as limber as paper & very pliable = It would seem that some unknown substance had been dissolved out leaving nothing but a sponge of Carbon = = I find after 1 hour ivory returns to white color.

Oil Mirbane after 2 or 3 weeks semi dissolves & gradually softens like soap or Cocoanut oil

Spirits Turpentine & Iodine after 3 weeks a precipitate formed which clouded the turpentine, apparently a demulcitic

Hyposulphite Soda is apparently freely soluble in Spirits Turpentine, The Crystal of Hypo. after 3 or 4 weeks melts down to a liquid ~~when~~ when shaken some what clouds the liquid showing that it is not desiccated. The turpentine smell can be easily detected –

Phosphorus,

Benzene & Iodine after standing in bottle several weeks stain (probably superficially) the inside of glass: ~~take~~ dark brown solution so that that one can scarcely see through; perhaps there is a compound of Iodine with something from the Benzene

Iodine quite freely but can be easily scratched with any thing hard showing it to be only a layer or deposit.

Apparently Saturated Alcohol. Solution of Salicylic acid ~~is~~ great preservative power.

Turbine apparently dissolves Sulphur freely & its preservative power is greatly increased. I think there is something in it

& it may be found that certain liquids which dissolve Sulphur will have great spectral power dispersive –

Aniline Oil softens & makes hard rubber like Mirbane, but it does not touch or even dissolve Caoutchouc after 6 weeks' –

White Solution permanent.
Alcohol & Bichloride of Tin, permanently Clouds Alcohol & poisons –

Vapor of Iodine penetrates deeply into Beeswax for instance the wax around the glass stopper of an Iodine bottle became black clear through

Alcohol dissolves Glacial phosphoric acid after a long time 2 or 3 weeks apparently 2 sets of Crystals separate on Camphor spongelike the other long needles. ~~and the almost~~

In a Rain water Solution of Tartarate of Soda a jelly accumulates on the top ¼ inch thick even on a dilute sol what is the substance = Lupulin also to a lesser extent

in a solution 1 gram Amygdalin 100 cc HO.
a scale Crystal forms at bottom which
has the appearance of an Ocean shell
its shape like this
after the 2nd, Sol 3 weeks old

Sol Borate Baryta 1 gram 100 cc HO. a
Scale Crystal form. Inch square just like Mica

Sulphate Morphia 1 gm 100 cc HO. a needle
Crystal 1/12 thick inch half long form after 3 months

5 gm Sol of Cyanide Pot in 100 cc HO. in an
Calcium white 7 weeks but the 20 gr.
40 gm in 100 cc turns very red. replaced
6 days colors & blackish brown precipt
collect at bottom, what is the
Colored sub Cuprec =

5 gm 100 cc Benzoate Soda Collect a gelly
thick in 3 weeks, while the 20 gm 100 cc HO
does not. The 1 gm does but not
gelly 1/2 inch thick Collect on 100
gm Solution of Licorice

40 gm 100 cc each of ferrocyanide of Pot
& ferridcyanide give with platina
blue mark quick sensitive

40 gm 100 cc each ferro & ferricyanide Pot. Salt &
Gallic Acid, Blue on O. Red on H good.
slow double current paper

Sulphurous Acid Converts
Aniline Violet into Aniline Blue
or purple – but the Color
gradually goes

After with the Sulphurous Acid
turns it nearly white if solution
be filtered the paper dipped into it
is white, it gives an aniline Violet
mark on O. [illegible] but
paper turns violet [illegible] a minutes,
By [illegible] solution of
the Sol [illegible]
No mark
Made [illegible]

[illegible] – that the paper [illegible]
becomes Colored in [illegible] with
the Air. The Hydrogen paper not
[illegible] mark the Oxygen paper (9e)
the [illegible] Salt –

Discovery

When aniline oil is treated with Nitric
Acid (fuming) and then thrown into a large
quantity of HO. a precipitate takes place
and a yellow coloring matter dissolves
in the water, If this be filtered off
it may be enormously diluted without

destroying its delicacy to electrolysis.
A strip of paper be wet in the
Solution & gives on the Oxygen platinum
point a reddish mark, not very brilliant
rather dull, by 3 cell Carbon Cell, this marks turns
greenish. If you increase the resistance to
1000 ohm the mark is green when formed
20000 ohm may be used without any
material weakening of the mark = But
the most remarkable thing is that if the
Solution of Nitrate of lime & Chloride of
Calcium Good added no mark is obtained
at all or short circuit & it only commences
to appear after 2000 ohms have been
inserted and gradually increases in
sensitiveness until 10 or 12000 ohms
have been put in. The mark is seen at
20000. 1886 This is probably due
to the fact that with a certain battery
power the Nitrate of lime or Chloride
is decomposed & the Carbonate formed in the mark
and it is not until
the current is so weakened that
these substances are not decomposed that
that free oxygen is given off at point
& oxidizes the aniline. This opens a new
field in lithography, as we may by
Calcium Chloride Solutions, have a mark
1/2 of a Roman letter by a weak Current
& the other 1/2 by a strong Current & in
many other ways use it. Even in the
dot and dash for it can send a
strong Current to make the spaces
which will not record & with the
weaker Current of the state discharge
to record.

Sept 11th 1886 J. J. Edison

Good EMF Solution Sept 11 1886
J Edison

Note Aniline as described on last page
mixed with Chloride Calcium H O Solution
& neutralized so as to have excess Caustic
Soda = this decreases on 20 000 ohm
3 cell Carbon zinc platinum & increases on O,
mistake Cant ~~fall freely through~~ 20 000 ohms;

Cellulose Solvent = Sept 11 1886
J Edison

I placed some tissue paper in a bottle
containing crystals of Chloral hydrate three
weeks ago, having noticed that the Cork
Stoppers (which are Cellulose) were dissolved
by the vapors, I now find that a
portion of the paper is dissolved, at
least it has every appearance of it,
having agglutinized & is somewhat
transparent, while the Cork also thrown
in at the same time among the
crystals is unmistakably dissolved,
I took the paper out and put in a
test tube with alcohol, this didn't
appear to dissolve it more; heat it,
also put Camphor in, also Chloroform
no increase in solvent power noticed
I have Corked the tube & hand it away
& put fresh paper in the bottle
I took some crystals & mixed them
with paper & put in a test tube to
melt the Chloral by heat, it
appeared to 1/2 semi dissolve the paper
put chloroform in this didn't help
it - Corked & set away = put some
paper in tube with Crystals Chloral
& Bisulphide Carbon, have set it away

Electromotograph Experiments for last 5 days.
After trying a great variety of disks of paper upon the Chalk, both hard glazed, bibline, and high lead glaze, we thought of Silk, Cut a washer of very thin Silk. wet it with a solution of Caustic Soda and Ferrocyanide and laid it on the Chalk when the results were splendid and exceeded ~~anything~~ Everything tried (papers & chalky subs) afterwards we tried a number of Silk disks & different Solution but we did not afterwards obtain such good results as with the first disk of Silk which may be attributed to some trifling change in the Conditions, = We notice one Thing about Silk which is different from anything yet tried and that is its beautiful Evenness as seen under the Microscope: and the great pressure you can place upon the EMG lever without abrasing the surface. In fact the point run in a circle on the silk disk for 1/2 an hour ~~+~~ with considerable did not show the circle or an abrasure Even when placed under the Microscope 1 1/4 power and even when it has been used for 2 or 3 hours, a thorough soaking of the disk Caused this circular abrasion or track to disappear, My opinion is that a disk of Silk would last for a week at least, which cannot be said of any other substance Known to me,

Sept 14 1876 W.E.

A strange Curious thing about Silk in the relation is that it only holds the chemical solution on its surface, the solution not penetrating the fibre itself as is the case with the paper, ~~and~~ it holds water only by Capillary attraction in the same manner as a little piece of powdered glass would attract & hold water by Capillary attraction

Sept 14 1876 J.A.Edison

After trying a very great number of experiments we found that the mechanical vibration which we felt had on a metal disk & dry silk became great when moistened and caused the undulation of the signal, We also found that although the Carbonic Soda & Ferrocyanide Solution had great delicacy it could not be substituted to any extent, like acetate of mercury & Carbonate Soda or potash which is attributed solely to the fact that it slips on Oxygen whereas Acetate of Hg & Carbonic Soda or potash increases friction on Oxygen. Then with the Ferrocyanide solution a disk is used with one current lubrication takes place & when the Counter charge of the magnet comes it also lubricates so in this case Compensation by a reversal current does more harm than good in fact prevents the Effect from working while if we use Acetate of Hg & Carbonic K or Na the magnet it with a magnet is shown mainly low in this case the Counter current acts to increase the friction & we thus get double the working difference besides allowing of the use of a Condenser when Cutting out constant Currents, However after finding the important part played in modifying signals and causing erroneous results precisions by the unevenness in friction of Mechanical Substances it occurred that this might be compensated for by securing to a shaft several independant levers provided with platinum points & resting upon the disk of metal. Each lever being held down by a spring and working entirely independant of the other yet all serving to give motion to the lever which closes the circuit. A drawing of the device is shown on page 23, Vol. 5. We had it made and attempt made in a very crude manner and gave great satisfaction. Since the with

the inferior solution we were using though any arrangement yet devised, The theory of using several independant levers to obtain an even friction was this that any bad spot on the disk would entirely destroy a dot or dash if one point were used or one half of the disk might be better than the other half (10) from edge to centre, comparing say 1/2 doz words to some heavy + 1/2 doz light whereas with several levers a bad spot acting on only one lever would be insufficient to give a false signal it being necessary that the bad spot should pass at least under 2 if not 3 levers; and if one half of the disk had more friction than the other the other half will have more hence 2 levers may be on a dirty & 2 on a more frictional surface hence success; but we found that owing probably to the inferior manner in which the levers were made & their looseness upon their fulcrum the run about on the disk, We then changed the style slightly and made a 4 ~~spring~~ pronged spring as shown on page 20, Vol 5. This worked beautifully smooth on dry silk = We had previously been out of Acetate Hg & having need 2 oz we made a Solution with Na + K and unfortunately use it = (10) Na Acetate = found that on wetting this dry silk mechanical vibration came in quite strong = and the prong that the four points did not give enough Compensation which we attribute to the fact that they are all joined together and if one lifts by a piece of Acetate Hg or grit it drags the next neighbor, thus increasing the friction which was not the case with the four levers ~~and~~ another thing

which militates against this form is that the current passes under each point at different rate of speed and a hard spot on the minor spring would not be so effective in neutralizing as in the outer or Helicter Marks faster; & I believe the relay lever style is the best, but the springs should be separate and run independent all the way to the lever and have their pressure put on their ends & at the same time be arranged to run all or nearly so in the same channel & nearly equidistant from the centre.

Sept 14 1876 T A Edison

While experimenting with the form this was considerable modification of signal, with silk band in platinum fingered clock & mounted with thick black Candy, Ac Hg Na Solution and we could obtain on 140 ohm W U relay & 800 ohms & quite reasonably good words at 100 words per minute speed, having tried an experiment previously of allowing a point to run on a silk diaphragm with only one underneath, and noticing the absence of mechanical vibration it occurred that perhaps the silk band on too hard a substance we then put a piece of ordinary chem paper moistened with the Hg solution under the silk so as to allow of a quiz, the result we striking mechanical vibration nearly ceased and with a single spring pressing on silk we could receive nearly at about 100 per minute through 25000, 26 cell Cond rd = shunted with 140 ohm W U Relay only = and with 800 ohm + relay we could receive at 200 words per minute 100' of feet without a battery or Good signal thus giving best results. Even obtained in the Eng 1st Hence if a proper to enforce that silk is the best for

a surface of all substances yet tried
2nd That Acetate Hg + NaO. is the best solution both on account of its delicacy & increase of friction on O. by removing the current
3rd that a quiving substance must be placed under the silk, ~~th~~
4th that several levers or springs all independent of each other with pressure on their ends and each supporting to move the central lever and all arranged so that the axis is as desirable or nearly so from centre of clock —
5 that the point on these levers or springs should be as small as possible and be very smooth,
6th That the relay lever movement is the best
7th That the slower the enquiring runs the less the effect of mechanical vibration,
8 That great care should be taken to eradicate all friction & shake in the mechanical moving parts.
Sept 14 1876
9th to put the solution even on the silk & to use it quite dry =
10 to obtain your normal friction by the use of mechanical & not by excessive pressure

With the spring 4 point silk + paper underneath we started the line with 60 sheet of Cardium at sending end and recorded direct on anti paper at speed that could not receive owing to weakness & failing + which could not be shunted = with Eng. under same conditions we could get at fair at some speed and sometimes 100' of words without a battery shunted with a W U Relay + 600 ohms =

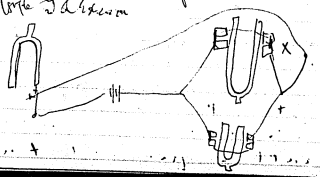
We are now trying a little side experiment placing a cup on disk with a hard rubber centre (page 24 Vol 5) & shaft with disk running in cup in which is a muddy solution of Kaolin & the Reg Solution. This will give a tolerably smooth friction & if there is any working difference it will be OK's I will mention that the disk is of brass whereas it should be platinum to give it a fair trial =

ACOUSTICS

Transfer System Octuplex

Last night got the new set of local forks set up for working 8 messages, the forks especially the high on work beautifully. But the others do not work so even one making an excessive amplitude and sticking the magnet which if it is not allowed to do gives nearly sufficient amplitude (Carefully Examine) but the other one does not give sufficient perfection. Even when sticking the magnet sometimes it has to be set 3/4 inch ahead of the other to balance; there is not so much one that gives great amplitude, but perhaps it is due to the working of the low resonance magnet of the high fork with the higher magnets of the low forks & differences in battery on one fork & the other. The Commutator had to be made an factors on account of the difference in resonance of the two magnets.

Sept 14 1876 T A Edison

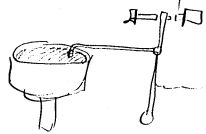


X magnets have together 24 ohms while those on the high forks have only 6 ohms this gives them an undue advantage especially if there is much internal resistance in batteries, if both are in one circuit X works with great power but high fork magnets do not work, we adjust up and found had connections wrong. Changed it = then found that spring connecting wires kept breaking fixed them, then found 38 cells combine at one end would scarcely move the common WU 140 ohm relays increased its effect by shunting relays with 200 ohm thus causing discharge from magnets themselves to bridge over space between waves, still too weak, put on NY battery which was very weak this made it about same, added one this made it stronger got it on one, found bug in harmonic at receiving end fixed, got it on 3 but circuit got it on other wires kept breaking on forks, We are now engaged in obtaining & testing Continuity by a sounder, closing proper points with a metallic wedge,

Sept 14 1876 T A Edison

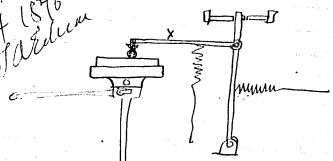
Page 56. Top = We have just finished trying the disk with a muddy (thick) mass like butter) of Kaolin & Reg Na Solution in which the brass disk runs we get a very strong movement of the disk with six cells on short circuit but scarcely any with 150 ohm rheostat = The surface was probably too great besides the surface was brass, to obtain proper friction had to run engine rather fast = Natural working & that is that lever is strong & at a close rather quick but normal

friction Dont "catch" quick enough to draw it away rapidly it being mushy "gives" whereas if it was rapid stiff such as paper it would get its normal friction instantly = it proves one thing and that is that a galvanometer could be made with an immersed disk in a liquid of considerable specific gravity. Afterward we disconnected disk and let wire connecting disk with point lever rest in mushy stuff. The action was much more delicate & rapid & was sufficient to work mechanically with through the 110 ohm relay. Thus



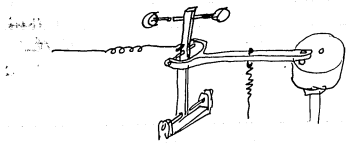
This also proves that you must use small surfaces to concentrate your action on the smallest point that is possible to use. We are now trying what I think is going to be a success. Thus

Sept 14 1876
Edison



on the end of x is a long platina point with a small ball of cotton or other yielding substance covered with silk tightly and wet with the regular solution it resting on a bright

polished platina disk with this giving point and a highly polished disk perfect even friction ought to be obtained with great difference = Edison is now making it = We have just tried it and it works very well. The bag flattens out owing to pressure and this causes after few moments an uneven friction but the first few moments gives absolute even friction. Could this bag be made to stand longer or could be easily changed it would be valuable but Edison has gone back and made the last arrangement which gave such good results thus



This works very nice has some bugs but current wipes them out. A disk of paper moist but rather dry is laid on platina over this is laid the silk tightly drawn the silk is then covered with a thick paste of the Iodide of Hg & NaO, which has just sufficient moisture to connect the paste through the silk with the paper underneath, this paste surface ought to be polished, but after a few moments the point polishes a groove which fit shines all the way round gives even friction, but gives a fine mark if portion is seen to be unpolished still this false jerk is weak & current wipes that

we notice something very prominently with 6 cells. Through 150 ohms shunted with a 12 ohm sounder giving reversals the margin is considerable & when shunt is disconnected and all the current passes through paper the working difference is greatly reduced. Whereas if the reverse current performed no function it should be stronger as it gets a full current. This is what makes the decided advantage of the Wheatstone solution so marked.

Acoustic

Continued from page 57.

We found that the Carbonized Cell was OK but the trouble was all caused by Gilliland giving us a wrong diagram of the connections. We straightened this out and then found the side that was at it was Gotti and we succeeded on short circuit in balancing and sending in opposite directions even when all the other keys beside the mes sending were closed or open. We then tried it on Philadelphia line and it worked about as well. 4 sheets Carbonized. We then closed for the night and Adams then in PM run the loose connections on table nicely, we then started again worked several hours and I then discovered that he had misplaced one of the wires, rendering it impossible to balance one end while the other was OK having got this OK we worked fairly although troubled with want of battery power. I then changed the method of operating the Carbonizing forks & line

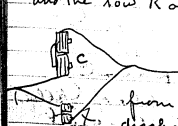
I placed in a local circuit one of the ordinary low forks used one prong to open & close its own circuit, and the other prong with two springs & points one to close the line circuit by high Resistance magnet forks and the other to close a local circuit by the other high resistance magnet forks, after making this Connection found that the other local forks worked even & nicely at both ends which is not the case with the other way the reason of which has already been explained, but caused not get anything through the line at either end = closed = ~~[illegible]~~ This evening started forks with 60 cells Carbon (with battery) each end found current OK but Concentrated Galvanometer will yet cause work on all four without mixing. found that the timing was very much out readjusted Carbonizing forks and got nearly even - current increased in strength and we succeeded for the first time in sending Eight messages on ~~[illegible]~~ one circuit. a feat never before accomplished with morse apparatus 800 ohms was in the line, owing to the fearful storm we are unable get one Philadelphia Loop. I predict that this apparatus will require about 400 cells of battery at each end on a 300 mile circuit. The Quadruplex requires 200, but with this ~~[illegible]~~ battery sometimes may

Sept 17 1896.

may be worked out of the same battery so the excess over that used in the Quad does not amount to much in fact it is economical, besides 8 messages in the product = I also predict that this apparatus will work better & have more Margin than the Quad when it shall be improved as we shall that apparatus. After Running for four hours we put Main battery on and find Circuits ok. put 1600 ohms in artificial line, & with 2300 ohms and as there is 700 in each side Bridge making 3500, and Relay Resistance is 240, this makes bal complete according to resistance, We send on all 8 Keys & all come clear on all 8 Relays = We now shunted line (not to Earth) with 75 sheet Cards takes 48 to balance on artificial, We now put condensers in Centre of Line, 800 ohms Each side & ground other end. and find that we get every thing clear requires no change in resistance but adding 24 sheet Cards at Each end to balance;

Sept 26.

Between Sept 17 and this date we have been trying various Experiments, and find that owing to the Magnet Discharge our plan of overcoming the Excessive resistance of the magnet after the slow fork and the low R of the high fork by connecting thus



is a failure as the discharge from the magnets are unequal that from X being the greatest hence C discharges uselessly the extra current from X passing through it in a contrary

direction while X is prolonged by its own extra current This necessitated a great change in the contacting fork springs as more or less battery on the local forks generated extra current of different strengths, we obviated this by using only one spool on each magnet of C and connected both it and X in the same circuit thus destroying the closed circuit in which the extra current could circulate and do mischief = We also tuned the forks so that they would start of their own accord when the magnets were some distance away. I find that the tension on the contact springs and the portion of time when the fork is touching and not touching is an important factor in keeping all the forks in unison; to obtain a perfect unison the springs should be in contact with the forks all the time, and the tension should be very nearly alike, I also find that tuning forks may be adjusted to any rate by a spring pressing against their end. instead of weighting them, We now have the two contacting forks in the same circuit which ckt is operated (1) opened + closed by a spring & point on a low fork local, and I have the switching fork local points adjusted alike on both forks so they close simultaneously and I find this to be correct and the ckts didnt change last night at all after we made the change of C.T.X. Having got the unison practically and theoretically Correct and reliable, we find can do first class work on Resistance line with 80 cells Called Each end with 2 3 4 5 6 or 8 thousand ohms = But

when we attempted to work the Phila loop 120 miles we found that the slate change invariably changed the current throwing No 1 Mesg on No. 2 Relay & No 2 mesg on No 1 Relay I can only account for this by supposing there is a retardation of one pulsation or the $\frac{1}{120}$th of a second, in the passage of the Current, this would do it. Allowing this, I could get 4 message at either end fair fairly that could balance fine enough to get it clear although you could read it, but taking in consideration that there was very considerable Escape and there was only required 1000 ohms to balance & we having only 80 cells called this was a good showing. We ought to have had 3 times as strong a received Current and as you can balance a strong outgoing Current as finely as a weak one the intrusion would not be so near the strength of the Recd Current. We use back point relays Now and close the Sounder by stopping of the Current We think it works better. Repeating Sounders appear to improve equal but they are hard to Manage;

Electric Sewing Machine

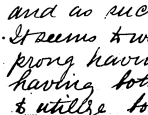
Oct 22nd 1876

Edison's idea that the greatest amount of power can be got out of a magnet by the aid of a tuning fork seems to stand good so far. We applied the principle to the driving of a Wilcox & Gibbs sewing machine and succeeded in stiching through 6 thicknesses of cloth at a speed of 82 stitches per minute with the following device:—

Fig 1

A is a fly wheel on same shaft as 300 tooth ratchet B. This ratchet is driven by 2 pawls D & E working by prongs of 12in fork giving about 60 vib. per minute. This wheel A was connected by belt to sewing machine This device was made from stock in hand and was only a preliminary experiment and as such far exceeded our expectations. It seems to want a much larger fork, each prong having large weights on & each prong having both push & pull pawls on so as to utilize both backwards and forwards movements of prongs. I now altered the ratchet to 30 teeth and put it directly on the sewing machine shaft thus:—

Fig 2



A is ratchet fastened directly on to shaft carrying fly wheel B. This was run in the same manner as Fig 2 only clicks were altered to suit the upright ratchet wheel. This did not work so well it seemed to require more power as ratchet was smaller.

It seems to be necessary to get some motion on wire that will not allow the fork to throw out. Monday Oct 23 3 a.m. 1876 Chas Batchelor.

Discovery

Nov 3rd 1876

I have three bottles containing in a 100cc HO. 1 5 + 20 gramme solution of Tannate of Iron. I find after many weeks that a thick deposit has formed on the side of the bottles facing the light. I do not know how long it took to bring this about, on the 1 gramme solution it is thin & clean on the 5 gramme from some cause (poly bottle been exposed all round) the deposit is all round but on the 20 gramme it is sharp where exposed very thick but not so clean as on the 1 gramme solution = This fact can probably be used in photography and its allies, for printing etc = [illegible] T. A. Edison

Phenomenon - after many weeks there appears a crop of crystals both at the bottom of the bottle & floating on the solution. These crystals are of amber color and apparently square 1/32 sharp edged and are very transparent = I never saw such crystals from crystallizable chemicals = The solution is 1 gramme of Acetate Strychnine in 100cc Rain water.

Phenomenon 14 grammes of Acetate Uranium 100cc HO Crystalizes only on side of bottle exposed to the sun - other side in diffused daylight = these crystals creep up on side bottle & where 1/4 inch from surface of the liquid = Same with 8 gramme 100cc HO proto-acetate Copper - creeps up 1/2 inch deposits large crystals in quantity = Same with Granule Mercury 20 gramme Sol = Same with Acetate Morphia 5 gramme Solution, Cant say how long that takes crystallizing = poly 1 month at least = also formate Copper in 4 10 + 20 gramme also Oxalate ammonia in 20 gramme Sol & Many others = Sulphate Aniline 10 grs in 5 gr. shows greatest. Crystalizes from much of solution in bottom 4 inches above surface of the solution the [illegible] may be due to pouring some of it out [illegible]

Phenomenon = 9 water in bottle ammonia 10 & 20 gramme solutions & another sale which show a fungus growth (re) cotton like stuff that when it settles it settles at the bottom & back further from the sun —

Phenomenon: 5 grams Gum Myrrh in 1 gramme Caustic Potash Sol 100cc a sponge like cloud rises up in the solution in that part of the sol towards the sun = it doesnt adhere to side bottle or apparently touch it - its clear on other side =

Phenomenon - Noticed that certain bottles & Sals gave shades of Colors out of 300 only 5 gave them distinct & these were corrosive solutions, 1 gram Sol Caustic Pot gave it good also Oxalate Pot = Changed bottle & which appeared to diminish it, very poor bottle may be something in it - try change Phenomenon (Oxalate Ammonia 5 grm (Caustic Baryta 1 gramme, Sodium Soda 5 grm) 500 mls gm Caustic Potash = Nov 3rd 1896 T A Edison

Nov 4 1896 T Edison

Stopper washed in 1 gramme Sol Cupric Chloride held over lamp soon blacken & give valuable blue light plays around paper very pretty =

Discovery

On about half of the bottles containing the 1 5 10 & 20 gramme solution of the sub-salts in 100cc Rain water I notice on the side of the bottle towards the wall & the least exposed to the light ~~that~~ and running from the surface of the liquid nearly to the cork a bow, like a rainbow running up from one point on the horizon to another point but it consists of drops of water (no color) this, all shew the bow -

Nov 6 1896
T A Edison

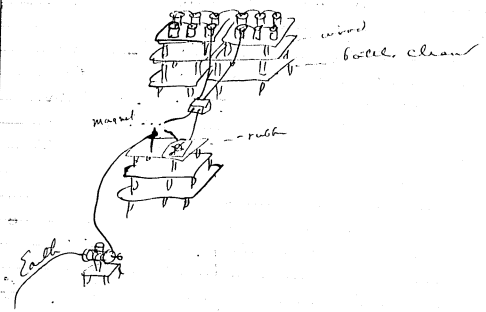
Phenomenon =
Certain kinds of tissue paper if placed on the palm of certain persons hands curl up and thick or brat (re) curl up then uncurl slightly then curl up again & keep doing this at apparently regular intervals for any length of time = on the palm of some persons it cannot be made to curl or move.

Nov 6 1896
T A Edison

Nov 5 1876

Etheric Experiment.

12 Cells Carbon Battery, connected in Series



with 6 ohm magnet zinc cylinder on magnet head brilliant as usual = ~~put zinc cylinder 6 inch away~~. Took 5 pound bundle no 16 branded office wire. Coil 10 inch diameter 4 inch hole 3 inch high. put cylinder of Copper in centre, brilliant spark. put zinc cylinder 6 inches distant from Coil & Copper, still plain, Wrapped this Cylinder with but 1 turn of office wire around it touching ~~separated~~ = no spark then after 1 minute trial =

5 Below Zero - Dec 10 1876. E-1647

No fire in Laboratory fearful Cold great wind Storm nearly blown windows down had brought down 20 poles (Telegraph) Record of phenomenon of freezing of 6 different Chemical Solutions.

100 Milligrams Citric Acid in 100 cc H2O. Frozen Solid in 4 oz bottle transparent Cracked beautifully in Centre there is a Egg shaped piece which looks like Cotton. The surface towards Cork is very uneven Such as place transmed in other 24 hours

1 gram Camphoric Acid - 100 cc H2O = raised in place on top 1/2 inch = Gradually expanded bottle broke =

1 Gramme + 400 MG. Cyanide Silver + 100 cc H2O. Above frozen by 3 o'clock spread out from Centre in Curves 1/2 bending upwards + 1/2 downwards.

500 mg. Hydrate Strychnine same.

Chloride Zinc 1 gramme 100 cc same on end of photo tube in glass tube =

1 gramme Sulphate Soda ~~Supersaturated burst bottle~~

20 grammes pyro pulline 10 cc = Beautiful Brown Sublimation of crystals inside of bottle

E-1894

From (cyanide) compounds of potassium looks deep yellow.

1 gramme gum Guaiacum has fuzzy looking stringed egg in centre bottle with numerous streaks running from it

20 grms Nitrate (lead) throws up a bubble ½ inch high in centre on surface of solution

Picrotoxin 500 MG = White opaque column in centre & clear ~~at~~ otherwise looks as if ice had thrown the picrotoxin with great force = thus appears to illustrate that phenomenon strongly.

Iodine 1 gram in H2O 1 cc shows fuzzy column in centre coloured but liquid around it is clear = thus is like picrotoxin

Dimethyl Chloride Camphor (Iodine dissolved bottle sold off the small crystals)

June 6th 1897

Arsenite of Soda Strong solution on time shows Mica like crystals which on concentrated sol lay flat in stella and are perhaps ½ to inch diameter just like thinnest mica sheets by tipping bottle they may be seen = they coated the surface of the outside of the bottle of gave out prismatic colors mostly ~~violet~~ light green in weaker solutions Crystals smaller if they are crystals

The Corks of the bottles containing Iodide of Iron in solution become in some time dark soft and smell like Iodine. by squeezing them they are shown to be full of liquid which colors the skin yellow & is undoubtedly Iodine. This phenomenon is very striking both a 1 5 to 10 gramme sol in 100 cc colors cork = very dark - June 6 1897 : 1 gm sol Iodine in 100 cc colors corks same way not so deep though = smell same - 2 gr. Iodine 3 mo shows no color on cork

A 1 gramme in 100 cc Creosote disintegrates the cork the bottom is colored brown & all the small holes are smoothed. A small strength of Creosote

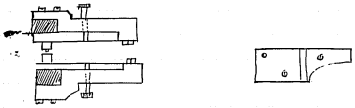
June 6 1897.

20 grammes sol Dextrin in 100 cc H2O. smells after 4 mos very ~~roll~~ like Cider (new)

Ter-Chloride Antimony completely disintegrates the cork so it became hard brittle, & is pulverized in the hand to a dark brown powder (dry) -

Crystals of Prolosulphate of Iron turn white in that part of the bottle which receives the greatest amount of light =

New receiver for Telephone July 8. 1878



Armature must be as long as the diameter of the spool

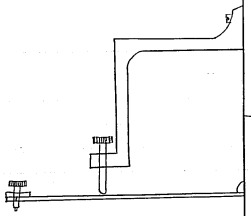
Copied from page 1. E.D.R. Record

notary stamp attached Oct 8. 1878

Wm. Carman

Electro motograph receiver for Telephone

June 19. 1878



Copied from page 2. this Telephone receiver Oct 8. 1878

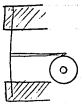
W Carman

Elec. Mg Exh for a New Receiver Sept 17. 1878

Caustic Strontia
2 Hyposulphite Ammonia
0 Nitrate Lime
1 Bisulphide Carbon
T Castor Oil
Sulphate Soda
Chloral Hydrated
4 Cust Ammonia
Nitrate Strontia
x Starch
x Oil Mustard
Neat's Foot
Ether
0 Nitrate Lime

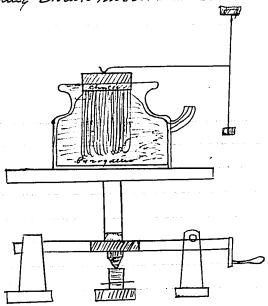
Copied from page 2. New Rec record Oct 1. 1881
W Cumm

New Receiver Sept 16. 1878



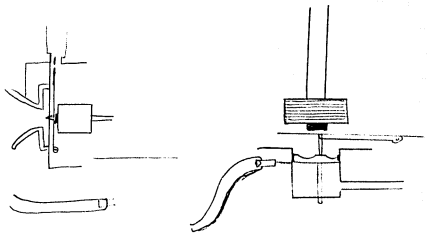
finely powered chalk
" " " mixed with turpentine
" " " Lamp Black
" " " Black Lead

Sulphate of B
Olive Oil & Pyrogalic
Nitrate Uranium - dissolve in Glycer Olive Oil mustard
Magnesia " " " "
Chalk and Pyr good - a wick made which attracts the Pyr up to chalk by capillary attraction. consequently keeping chalk moist



Copied from page 4. New receiver record Oct 8. 1881
W Cumm

New Receiver June



Copied from page 5. Her receiver re-arrangement Oct 1.11
W Carman

Telephone Receiver Sept 23. 1878

Chloride Calcium N 4 wont melt
Carbonate Potass " " "
Cinnabar saturated with a Solution of Caustic Soda Pyro. Glycerine and acetate Mercury — Good
Chalk and Caustic Soda. Good at first but does
Salt Petre and acetate mercury. Irregular Keeps dry
Chalk saturated with Solution of Caustic Soda pyro-Glycerine and acetate mercury Good after standing - very good and come even and good after running off
Caustic Soda — fused — N.G. —
Sulphate Soda and salt Petre - very bad - N.G

Copied from page 6. The Rec record Oct 8 1878
W Carman

Telephone Receiver Sept 23. 1878

Cork saturated with ammonia - N.G
Cork saturated with ~~f~~ Caustic Soda, Glycerine acetate Mercury
Pyrogallic acid. N. G

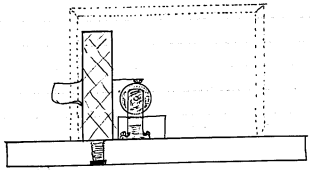
Telephone Receiver Sept 24. 1878

Chlorate Potash wont fuse	
Bromide Pattassium	N G. wont fuse
Sulphate Magnesia	N G. wont fuse
Ferro. cyan Potash	N G " "
Sulphate Soda	to deliquesant
Chloride Lime	N G. wont fuse

Sulphate Baryta powered and mixed with a Solution of acetate Mercury. pyro. Glycerine and Caustic Soda: works very Good but is rather to soft

Copied from page 7. Her Rec Records
Oct 8. 1878. W Carman

Sinking the Receiver Sept 26. 1878



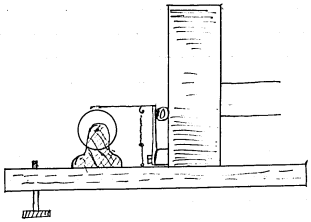
copied from page 8 the Rec Records Oct 8. 1878
W. Carman

Emy Recd Receiver Sept 17. 1878

Acetate Mercury & Cano Potash
Acetate Mercury
- Cianatic Potash
- Iodide Potash Iodide Soda
Nitrate Uranium
Oxalate Cerium on H. Tin - Fine. low heat
- Cupric Chloride
Lactate Zinc Silver - H-
+ Sanitaline
- Acetate Manganese
Cobalt
- Nitrate Magnesia
- Iodide Cadmium - Nic and Zinc
+ Santilene Copper
- Formate Soda — lead
Pyrogalic Acid
+ Liconice
- Carbonate Ammonia
Cianatic Soda - plor
- Tartaric Acid
x Bisulphide Carbon
x Turpentine
- Glacial Acetic Acid
Acetate Nickel
Molybdic acid Lead

Copied from page 7. New Receiver Record
Oct 8. 1878 Wm Carman

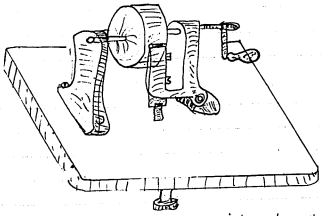
Speaking Telephone Receiver Oct 3. 1878



Copied from page 10. Rec Rec Records Oct 5. 1878
M Carman

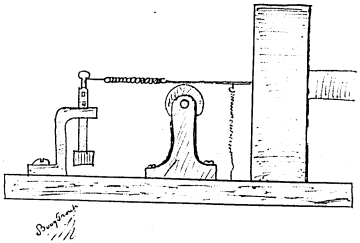
Recd Receiver Oct 8. 1878

attachment for burning discs



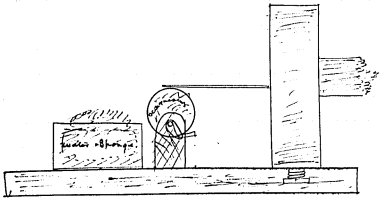
copied from page 11 New Receiver Record Oct 8. 1878

Speaking Telephone Receiver Oct 8. 1878



Copied from page 17. new Rec. Rec Oct 7 78
Wm Carman

Speaking Telephone Receiver Oct 3. 1878

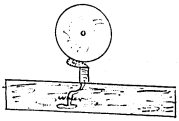


The above enclosed in a case to prevent exposition

delignement

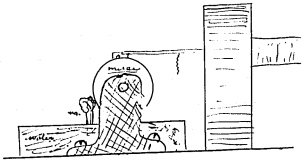
Copied from page 16. New Receiver
Record Oct 5. 1878

Speaking Telephone Receiver Oct 4. 1878



Copied from page 18. New Receiver Oct 8. 1878
Wm Carman

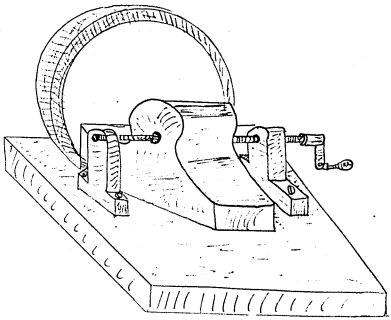
Speaking Telephone Receiver Oct 4. 1878



A Point mounted of some metal and should or rise, and attached

Copied from page 15. New Receiver Oct 5. 1878
Wm Carman

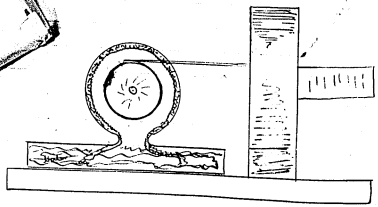
Speaking Telephone Receiver Oct 11 1878



Copied from page 16 new receiver Oct 8. 1878

W Cornman

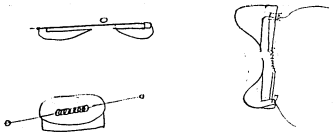
Speaking Telephone Receiver Oct 11. 1878



Copied from page 17. New Rec Rec Oct 8. 1878

W Cornman

New Receiver Oct 2. 1878



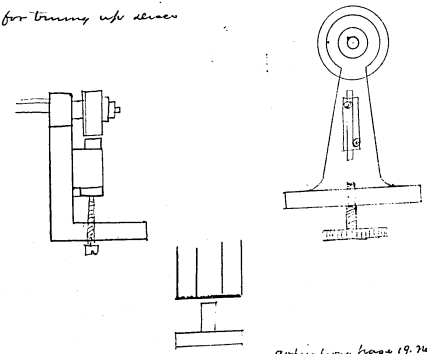
air draft covers platina and allows the resistance.

Copied from page 18. New Rec records Oct 8. 78

W. Cornman

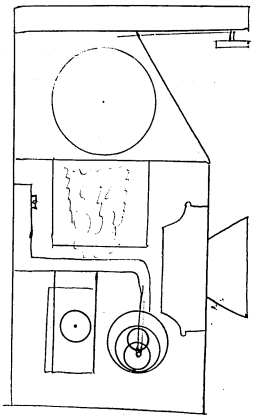
Speaking Telephone receiver Oct 2. 1878

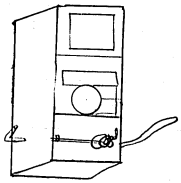
for turning up screw



Copied from page 19. New receiver Oct 8. 1878. W Cornman

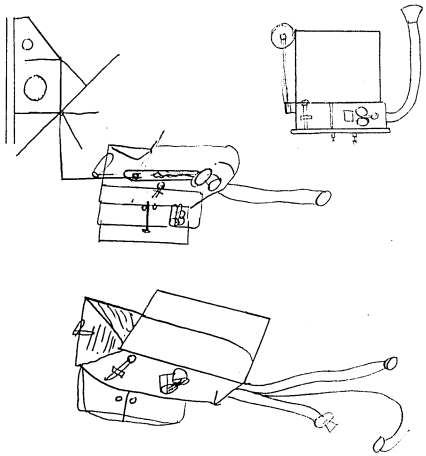
New Receiver Oct 7. 1878





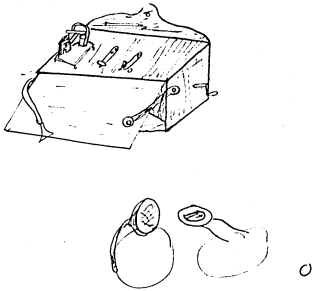
Copied from page 20 new receiver Oct 8. 1878
D Farmer

Experiment on New Receiver Oct 7. 1878



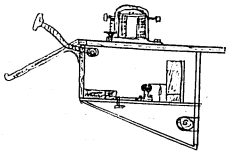
Copied from page [illegible] New Receiver Oct 8. 1878. [illegible]

New Receiver Oct 7. 1878



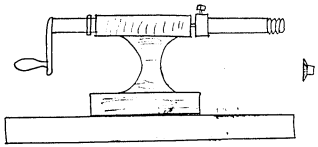
Copied from page 22 new Receiver records Oct 8. 1878
Wm Carman

New Reciever Oct 7. 1878



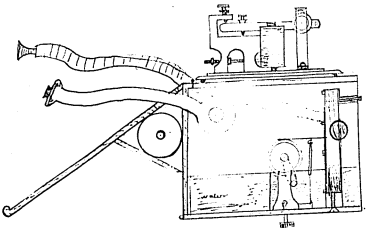
Copied from page 23. New receiver Record Oct 8. 1878
Wm Carman

Speaking Telephone Receiver Sept 19. 1878



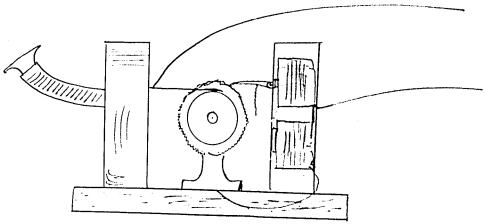
Copied from page 24. New Receiver Record
Oct 9. 1878. Wm Carman

Speaking Telephone Receiver Oct 7. 1878



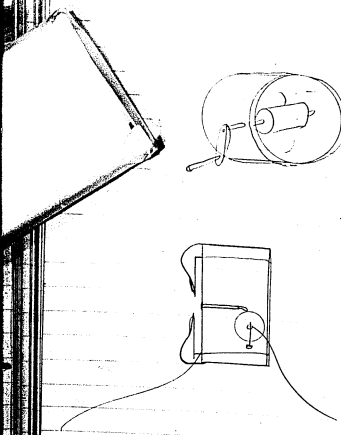
Copied from page 25. new Receiver record
Oct 9. 1878 Wm Carman

Phonomotor - Motographs Tel Receiver
Oct 9. 1878



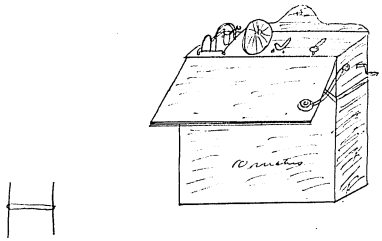
Copied from page 26 new receiver record Oct 9. 1878
M Cunnan

New Receiver Oct 9. 1878



Copied from p. 27. New Receiver Record
Oct 9. 1878 M Cunnan

New Receiver Oct 10. 1878



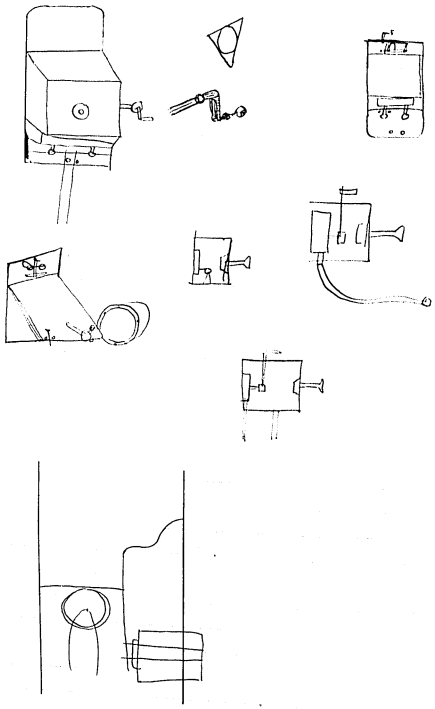
Copied from page 28 N. R. Record Oct 14. 1878
M Cunnan

New Receiver Oct 11. 1878

Receipt for making Buttons for new Receiver
10 - pennyweight chalk -
1000 Grains - Acetate mercury -
20 - minimum - Caustic Soda & saturated Solution

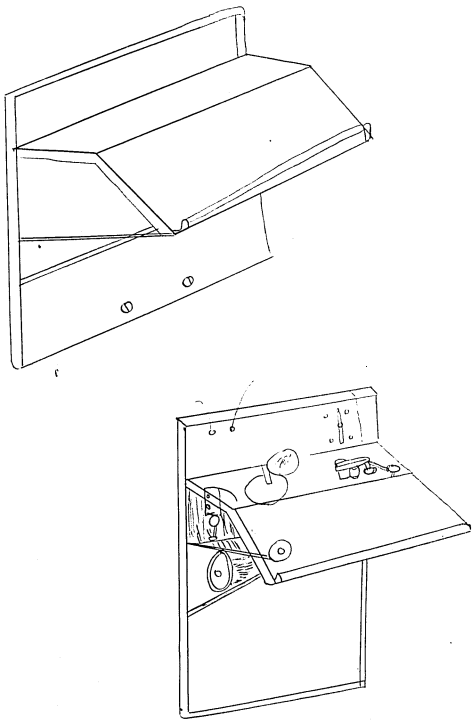
Copied from page 29 New Receiver Record
Oct 14 1878
M Cunnan

New Receiver Oct 12. 1878



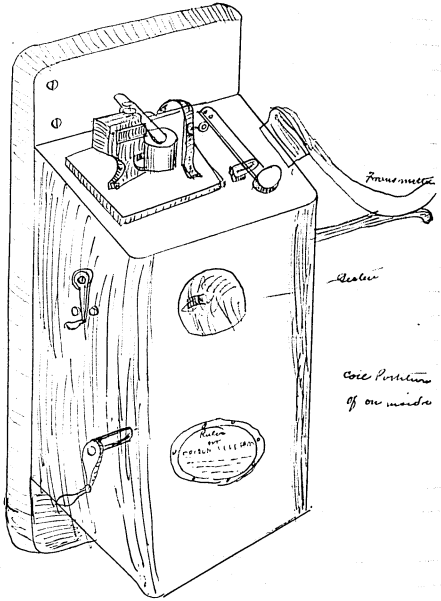
Copied from page 30 New Rec records Oct 14. 1878
W Bowman

New Receiver Oct 13. 1878



Copied from page 31 New Receiver Oct 14. 1878
W Bowman

New Telephone Receiver Oct 13.1898



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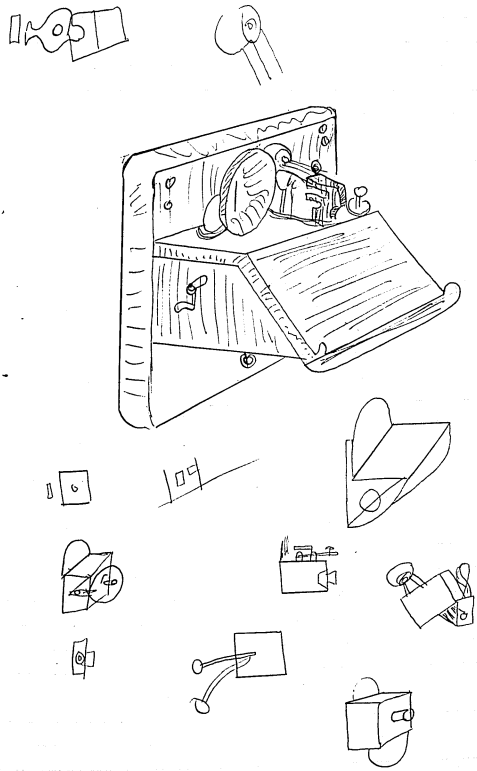
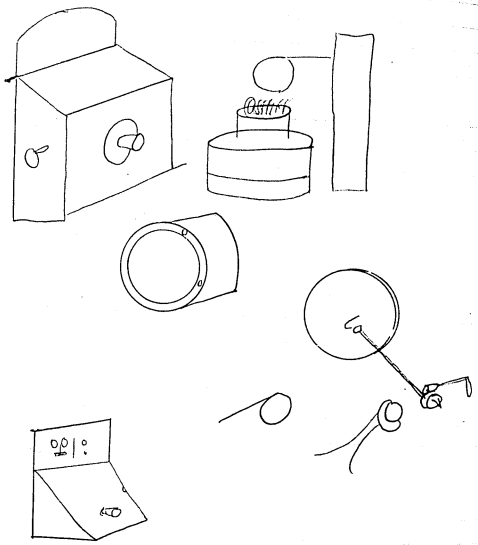
New Receiver Oct 13.1898



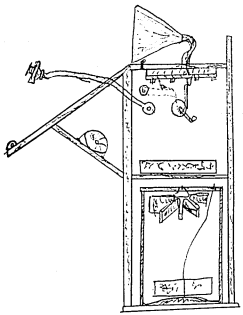
Copied from Page 33. New Rec. received Oct 14. 1898
W Cannon

New Receiver Oct 13. 1878



Copied from P 34 New Receiver record Oct 15. 1878
W Carman

New Receiver Oct 15. 1878



Copied from Page 35 New Rec records Oct 15. 1878
W Carman

L. W. Serrell March 5. 79

A U.S. patent is to be taken out on this for W.U. for which I furnish you a model. I also furnish you a second model to go with the Canadian patent.

This is the U.S. Specification

The object of this invention is to transmit and reproduce sounds telegraphically at a distance with great power and without loss of volume. The peculiar action upon which this action is based was patented by me. (Original Electro-motograph patent) and numbered an application of this action to telephony was also patented (or applied for) (L.W.S. This is the patent where a band of paper was used). The present application consists more particularly in devices which make the invention perfectly practicable for use in commerce and infinitely more reliable and effective

A is a cylinder of compressed chalk soaked in an electrolytic solution such as a caustic alkali that it may become a conductor of electricity. I will mention that any finely divided non-conducting material or porous body having capillary pores and which has no chemical action upon the absorbed solution may be used. This cylinder is sinned to a shaft B and the whole is rotated by the operator by means of the toothed wheels C & D and shaft and handle E & F worm and pinion may be substituted and

motor power of a clock work or analogous motor to replace the hand of the operator. Resting upon the cylinder A is a flat spring g connected to the diaphragm H this spring is pressed upon the cheek with a pressure of several pounds by means of the wire K + spring h the screw m serving to increase or decrease the amount of pressure. The Line wire X X is connected to the spring g while the earth wire is connected to the shaft on which the cylinder A is secured. If now the cylinder be rotated in the direction shown by the arrow and no current passes the normal friction of the spring g upon the surface of the cylinder A will be very great and the spring will be carried forward in the direction of the rotation of the cylinder this pulling inwardly the diaphragm H. If now a current passes whose direction is such that Hydrogen will be produced upon the surface of the spring g in contact with the chalk the friction will be reduced to an extent proportionate to the strength of the current, hence the diaphragm will regain its natural position and continue there so long as the current passes as the friction between the spring g + A is too small to produce sufficient traction. If now the current ceases the normal friction at once obtains. The traction increases and the diaphragm is instantly pulled outwardly. If now a current in the opposite direction is transmitted the effect is scarcely noticeable as the Evolution of Oxygen upon the surface of the spring g does not except with a few exceptions decrease the friction like Hydrogen but on the contrary generally tends to increase the normal friction hence I allow a constant current to circulate on the line and am thus enabled to utilize the opposite wave by causing them to weaken the constant current which is always in a direction to evolve Hydrogen on the surface of the spring g. for instance if no constant current

was upon the line the only waves in one direction would produce an effect whereas if a constant current is circulating one of the waves is added to that of the current and the other wave neutralizes or nearly neutralizes the constant current hence the tendency of one waves to produce a lessening of friction of say 5 units which added to that produced by the constant current say 5 together give 10 units. If now an opposite current is sent it neutralizes the constant current and we have the normal friction of the cylinder, whereas if no constant current was used one current would lessen the friction by 5 units + the opposite current would perform no work.

n is a receptacle containing water; resting in the water is a roller R composed of any flexible absorbant substance such as sponge or felt. A lever to which the roller is attached by which the roller may be brought in contact with the cylinder A extends through the box to the outside. The object of this device is to supply the cylinder with water lost by evaporation and make it a conductor to the electric current.

In practice when all the apparatus is enclosed in a cast iron case the loss by evaporation is very small and if the roller be held against the cylinder and if the cylinder be rotated three or four times the chalk will take up sufficient moisture so that it will perform its functions for a week or more without again wetting it.

The connections are as follows:
T. is the regular Carbon telephone transmitter placed in a local circuit with an induction coil Ic with local battery. If the position of the switch lever is on the button n then the current proceeds from the local battery X X via wire 1 thence through the primary coil thence via wire 2 to 3 thence to the switch lever thence via wire 4 through the Carbon transmitter thence by wire 5 to the post 6 thence to the battery. The sonorous waves of the voice are translated into electric waves of a position & regular character in the secondary coil of the induction Ir in the well known manner.
The connections of the main line are as follows. The line from the distant station enters at the post 8 thence via wire 9 to the bell thence via wire 10 to the key lever thence via wire 6 to the point p of the switch thence via wire 7 to the spring 9 of the receiver, thence through the moist chalk to wire 8 to and through the secondary coil thence via wire 3 to the switch lever which it will be remembered is in n thence via wire 4 through the transmitter to wire 5 thence to post 6 and thence via wire 12 to the post c which is connected to the earth.
I will mention that either of the posts 8 - c may be connected to the ground a line. It will be noticed that the main line passes through the transmitter which is connected to the local battery hence a portion of the current leaks into the main line and it is this portion which thus leaks into the line that serves as a constant current for short lines but if the line be too long or current so weakened as to be insufficient to produce a lessening of friction between the spring 9 and the chalk hence I insert one or

more cells in the main line. While the switch is in this position (ie) the lever in contact with n transmitting & receiving can go on simultaneously by turning the switch lever to the point p the telephonic apparatus is disconnected and the call bell apparatus becomes operative, the line enters at the post 8 passes through the bell via wire 9 thence via 10 to key thence via 6 to p thence via lever to wire 3 thence via 2 through the primary coil and via 1 to local battery through that to post 6 thence via 12 to post c to earth; by depressing the key the circuit is opened & closed & the two local batteries, one at each end, of the line, become operative to ring the bell.
I will mention that the two receivers herein described and the two transmitters may all be connected in one line and operated without the aid of induction coils but the results are not equal to that from the use of the coils, also that the Receivers will act as transmitters by reason of the fact that when the spring 9 & chalk are at rest the resistance of the whole is generally about 2500 ohms and this resistance is reduced instantaneously to 2 or 300 ohms by the slightest movement of either the chalk or the spring hence the movement of the diaphragm II by the voice produces the same result or nearly so as the Carbon transmitter. If advantage is to be taken of this fact the surface of the spring 9 should be reduced to increase the effect and an induction coil having a primary coil of high resistance used in connection with the apparatus although it is not absolutely necessary as the direct results are nearly as good. In preparing the chalk I prefer to use a salt of mercury mixed with caustic soda, the action takes place no matter what the proportions.

The mercury salt I prefer to use is the acetate of mercury.

I will mention that the moisture of the chalk may be regulated automatically by taking advantage of the fact that the normal friction of the chalk increases as it becomes dryer. A spring resting on the chalk is connected to the wetting roller & has such a pressure and counteracting spring that when the chalk has its proper moisture the friction during rotation is insufficient to produce sufficient traction to lift the roller but when it becomes dryer the traction becomes sufficient to lift the wetting roller & it supplies moisture until the traction is reduced below a certain point and it falls —

I claim the method herein described of producing motion at a distance and reproducing sound waves.

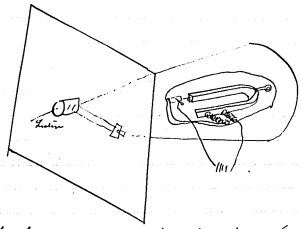
2d The use of a cylinder, disc or its equivalent composed of an inert porous substance moistened with an electrolytic solution with an electrode connected to a diaphragm plate or other body capable of rendering the motions produced by electrolysis audible.

3d — In combination with such cylinder disc or equivalent in a closed receptacle of a moistening roller or equivalent & supply of water substantially as set forth.

(and any other claims that may strike you as patentable)

Voltameter June 21. 1878

narrow aperature leading from a continuous source of sound and expansion of rubber closes aperture to greater and lesser extent

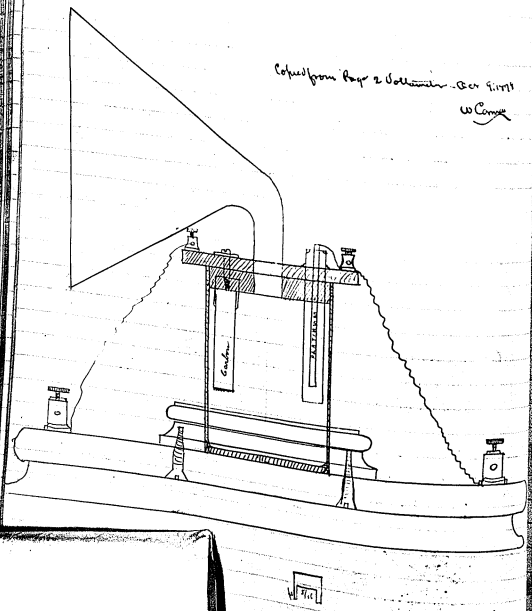


The slot may be the same as a spectroscope and may be opened and closed by a magnet galvanometer needle etc or by a strip resonating motion from a diaphragm having a tone mouth piece =

Copied from page Voc Records Oct 9. 1878

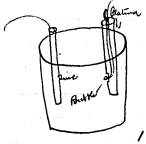
W Pierson

Sonorous Voltameter Aug 27. 1878



Copied from Page 2 Voltameter Oct 9. 1878
W Conner

Voltameter Sonorous
Aug 27, 1878



with measurement made as on attach.

1 drop released in 10 seconds

3 Cells Carbon 1/2 on

"	12
"	12
"	13
"	14
"	14 1/2
"	16 1/2
"	14 1/2
"	14 1/2
"	14 1/2
"	14 1/2
"	13 1/2
"	13
"	13
"	12 1/2
"	12 1/2
"	14 1/2
"	14 1/2

18.0
6.0
12.0 ÷ 13
12
60
60
0

Mean 13 1/2

After this we put in current 100 ohms
1 drop in 12 1/2 seconds
Now 80 ohms in current
1 drop in 13 seconds
" " 16 "

16
13
3.0
1/2

Copied from page 2 Voltameter Records Oct 9. 1878
Wm Conner

Voltameter (Continued) Aug 29. 1898

With 100 ohms in circuit

1 drop in 16 seconds.

1 " " 16½

1 " " 17½

1 " " 16½

1 " " 15½

1 " " 16

1 " " 16¾

7) 115 ½
16.5

97
86½
11

With 200 ohms

1 drop in 20 seconds

1 " " 20¾ "

1 " " 19¾ "

1 " " 19¾ "

1 " " 20 "

With 400 ohms in

1 drop in 27 seconds

1 " " 26½

With 600 ohms in

1 drop in 34 seconds

1 " " 34

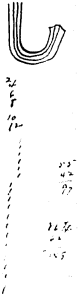
1 " " 34½

With 1200 ohms in

1 drop in 54¾ "

1 " " 53½

4) 109¾
54



Copied from page 4 Voltameter Record Oct 9. 1898

W Carman

Voltameter Continued

With 2400

1 drop in —— 86½ seconds

1 " " —— 87 "

With 4800 ohms in

1 drop in 189 seconds

With 9600 ohms in

one drops in 254½ seconds

1 " " 245 "

1 " " 257 "

168
39
207
35
242
60) 254½
242½

16 : 20
16.5 : 20 : 34½
20
16) 16.5 (1
16

200 : 400
34 : 54 : 86½
34
20
54
40
14
3) 42 (14
3
12
12
42
42

one drops mean 13½
16 ohms 17½
30 ohms (mean) 14½
100 " (mean) 16½
200 " (mean) 20
400 " " 26½
600 " " 34
1200 " " 54
2400 " 86½
4800 " 189

Copied from page 5 Voltameter record Oct 9. 1898

W Carman

Voltameter

with 600 ohms in

1 drop in 30 sec
1 " 31 "
1 " 32 "
1 " 33 1/3 "
1 " 33 1/2 "
1 " 34 "
1 " 33 1/2 " alarles to worn

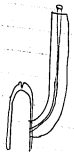
Put in one carbon cell and 600 ohms
1 drop in 165 seconds
nearly four times as long as with 3 cells
probably due to polarization & bubbles (investigate)
1 drop in 164 1/2 seconds
Put in one leclanché cell on 600 ohms
1 drop in 12 minutes 7 1/2 seconds

to see might

Copied from page 6 Voltameter record Oct 1 1878
W Carman

Edisons Voltameter Aug 31. 1878

This is the Boss way for the gas to come from the electrode



as the pressure was always very more chamber — B

Copied from page 7 Voltameter record Oct 1 78
W Carman

Bubble Voltameter Sept 13. 1878

Time 3 cells Leclanché about current 1

H O A H P

6 1/4
6 1/2
6 1/2
6
6 1/4
6 1/2
6 3/4
6 1/2
6 1/2
6 1/2
7
7 1/2
6
6
6
5 1/2
5
5
5
5 - 1/2

some bubbles commence to rise between large bubbles hence the variation
Closed pores of the plate up to prevent the above

Copied from page 8 Volt record
Oct 9. 1878 W Carman

Voltameter Continued Sept 13. 1878

5 3/4	5 3/4
5	6
5	5 3/4
5	5 3/4
5	5 3/4
5 3/4	5 1/2
5 3/4	5 3/4
5 3/4	5 3/4
5 3/4	5 3/4
5 3/4	5 3/4
5 3/4	5 3/4
5 3/4	5 1/2
5 3/4	5 3/4
5 3/4	5 3/4
5 3/4	5 3/4
5	5 3/4
5	5 3/4
5 3/4	5 3/4
5 3/4	5 3/4
5 3/4	5 3/4
5 3/4	5 3/4
5 3/4	5 3/4

6 Extra bubble between this and last

7 " " " "

5 3/4
5 3/4
5 3/4
5 3/4

Copied from page 9 Voltameter Record Oct 9. 1878

W. Burman

Bubble Voltameter continued Sept 13. 1878

5 3/4 seconds	
5 3/4	
5 3/4	
5 3/4	
5 3/4	
5 3/4	
6	5 3/4
6	5 3/4
6	5 3/4
6 3/4	5 3/4
6 3/4	5 3/4
6 1/2	5 3/4
6 3/4	5 3/4
6 3/4	5 3/4
7	observe from bubbles again
7 3/4	Closed up the plate Cette
7 1/2	5 3/4
5 3/4	5 3/4
5 1/2	5 3/4
5 1/2	6
5 1/2	6 3/4
5 3/4	6 1/2
5 1/2	6 1/2
5 1/2	6 1/2
5 1/2	6 3/4
5 1/2	6 3/4
	6 3/4

Recover

Copied from page 10 Volt Record Oct 9. 78

W. Burman

6¾		4¾	5¼
6¾		5	5¼
6¾	Observe smaller bubbles	5	5¼
6¾	coming from hole in paper	5	5¼
6¾		5	5¼
6¾		5	5¼
6¾		5	5¼
6¾		5	5¼
6¾		5	5¼
6¾		5	5¼
6¾		5	5¼
6¾		5	5¼
6¾		5	5¼
4¾		5	5¼
4¾		5	5¼
4¾	make hole in paper smaller	5	5¼
4¾	smaller bubbles also	6	5¼
4¾		5	5¼
4¾		5	5¼
4¾		5	5¼
4¾		5	5¼
		5¼	5¼
		5¼	5¼

Copied from page 11 Voltameter Record
Oct 9 1878 Cr Carman

Bubble Voltameter Sept 13 - 1878

4¼	4½			
4¼	4¾			
4¼	5			
4¼	4¾			
4¼	4¾	Perform front smaller		
4¼	4¼	look in 4th		
4¼				
4¼	Now put on Gold Plates with 3 Pin holes in the bottom			
4½	Rate Bubbles			
4½	3	3	3	
4¼	3	3	3	
4¼	3	3	3	
4¼	3	3		
4¼	3	3		
4¼	3	3	12¼	13
4¼	3	3	12	13
4¼	3	3	12¼	13
4¼	3	3	12¾	13
4¼	3	3	13	13
4¼	3	3	13	13
4½	3	3	13	12¾
4½	3	3	13	11¾
4½	3	3	12½	12¾
4¼	3	3	12¾	13
4¼	3	3		13
4¼				13
4¼				12¾
4¼				
4¼				
4¼				
4¼				
4¼				
4¼				
4¼				
4¼				

Copied from page 12 Voltameter
Record Oct 9 1878 Cr Carman

Bubble Voltameter Sept 13. 1878

Test Electro motive Force

3 cells Ballard Small size 100. ohms Constant

See over Average 18 seconds

3 cells carbon		100 ohms Constant
3 3/4		
3 3/4	4 3/4	4 3/4
3 3/4	4 3/4	4 3/4
3 3/4	4 3/4	5
3 3/4	4 3/4	5
4	5 1/2	5
4	5 1/2	5 1/2
4	5	5
4	5	
4	5 1/2	
4 1/4	5	
4 1/4	4 3/4	
4 3/4	4 3/4	
4 3/4	4 3/4	
4 3/4	4 3/4	
4 3/4	4 3/4	

Copied from Page 13 Voltameter Record
Oct 4. 1878. W Cunnan

Bubble Voltameter Sept 13. 1878

Tests to obtain Electro motive Force of Batteries

10 Cells Ballard Constant 100 ohms

No Cells	1 Cells	2 Cells	3 Cells	4 Cells	5 Cells	6 Cells	7 Cells	8 Cells	9 Cells	10 Cells
		53	12 1/4	6 1/4	5	4	3 1/4	2 1/4		
		67	13	6	5 3/4	4	3	2 1/2		
		25	13	6	5 1/2	4	3 1/4	2 3/4		
		61	13	6	5 1/2	4	3 1/4	3		
		30	13	6	5	4	3 1/4	3 1/4		
		57	13	6	5	4 1/4	3 1/4	3		
		29	13	6	5	4	3	3		
		55	13	10	5	4	3	3		
		30	13	9 1/2	5 1/2	4	3 1/4	3		
			13	8 1/2	5 3/4	4	3 1/4	3		
			13	9 3/4	5 1/2	4	3 1/4	3		
			13	6 1/2	5 1/2	4	3 1/2	3		
			13	7 1/2	5 1/2	4	3 1/2	3		
				7 1/2	5 1/4	4	3 3/4	3		
				8 1/4	5 1/2	4	3 1/2	3 1/4		
				8 1/4	5 1/2	4	3 1/2	3		
							3 1/2	3		
							3 1/2	3		
							3 1/2			
							3 1/2			
							3 1/2			
							3 1/2			

Average 8

Copied from Page 12 Volt Record Oct 4. 1878
W Cunnan

Bubble Voltameter Sept 13. 1878

Ground wire 100 ohms	Seat of cell	2 cells	3 cells	4 cells	Ballon cells	5 cells	6 cells	Battery 7 cells	8 cells	9 cells	10 cells	Gold Beater skin cells	No holes with cells
	5 4/16	46 1/2	12 1/2	7		5 3/4	4 1/2	3 1/4		2 1/4	2		
		45	12 1/2	7		5 3/4	4 1/2	3 1/4		2 1/4			
		42	12 1/2	7		5 1/2	4 1/2	3 1/4		3 1/4			
		42	12 1/2	7		5	4	3 1/4		3			
		42	12 1/2	7		5 1/2	4 1/2	3 3/4		3 3/4			
		41	12 1/2	7		5 1/2	4	3 3/4		3 1/4			
		40	12 1/2	7		5 3/4	4	3 1/4		3 1/4			
		40	12 1/2	7		5 3/4	4	3 1/4		3			
		40	12 1/2	7		5 3/4	4	3 1/4		3			
		40	12 1/2	7		5 3/4	4	3 1/4		3			
		40	12 1/2	7		5 3/4	4	3 3/4		3			
			12 1/2	7		5 3/4	4	3 1/4		3			
			12 1/2	7		5 3/4	4	3 1/2		3			
			12 1/2	7		5 3/4	4	3 1/2		3			
			12 1/2	7		5 3/4	4	3 1/2		3			
			12 1/2	7		5 3/4	4			3			
			12 1/2	7		5 3/4	4			3			
			12 1/2	7		5 3/4	4			2 1/2			
			12 1/2			5 3/4	4			2 1/2			

Proved here capacity of this Voltameter exceed with 1000 ohms

Copied from page 10 Voltameter Record
Oct 9. 1878 W Carman

Bubble Voltameter Sept 14, 1878

Porous diaphragm

Paper — To soft gas appears to burst at after short use

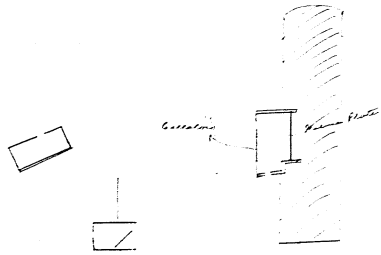
Gold Beaters skin. Better but softens by use and becomes useless

Cork — no better

Stopped up the hole top of the cell and fixed a Collodion face to the cell with hole at top and bottom thus (⊙). This collects the gas in the top of the cell. This also prevents the escape of small bubbles from the face of the Platina Discs after forming as above records more even —

Copied from page 11 Voltameter records
Oct 9. 1878 W Carman

Voltameter Sept 17. 1878



Copied from page 11 Voltameter records
Oct 9. 1878 W Carman

Bubble Voltameter Sept 16. 1878

After Instrument working over night found heavy blackish deposits on the negative Electrode possibly from the carbon used (Solution Hydrochloric used) — —

used fine platina wire in place of the carbon rod — result was the more energy giving off of gas at negative pole. probably this comes from the fact that the wire gives off its oxygen with more regularity than the carbon

Copied from page 18. Volt Record
Oct 9. 1878 Com Cunman

Bubble Voltameter Sept 17. 1878

Constructed a tube Voltameter to make comparative tests with bubble voltameter to ascertain degrees of constancy —

Tube Voltameter

7 Cells =	2' 1½"	2' 1½"	2' 1¼"	2' 1¼"	2' 1"	2' 1"	
3 " =	6' 6½"	6' 7"	6' 7"	6' 7½"	6' 7½"	6' 8"	

Bubble Voltameter

7 Cells =	16"	16"	14½"	14½"	14½"	14½"	14½"	14½"	14½"
8 Cells =	49½	48½	48	46	46	46	46	44½	44½

120 121½ 121½ 121.1 2 32½
4½
5

	Time	233	234	237	238	239	240	233½	236	236	237
Tube	Time	4	4½	4½	4	4½	4½	4	4	4	4½
Carbon	Bubble	5	5	5	5	5	5	5	5	5	5

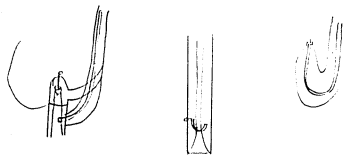
Copied from page 19 Voltameter record Oct 9. 1878
W Cunman

Radiation of Heat

Source of Heat	Degrees Radiation	Liquid in-bounced in Death	Radiation	Per cent retained
Gas Jet	200°	4	55°	
"	200°	9	65°	

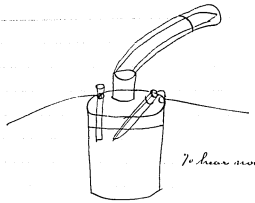
Copied from page 20 Volt record
Oct 9. 1878. W Cunman

Sonorous Voltameter. Sept 27. 1878



Copied from page 21. Voltameter record
Oct 9. 1878 W Cunman

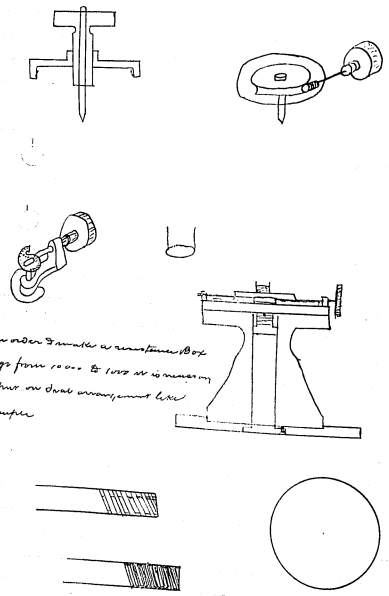
Voltameter Sept 27. 1878



Platinum wires in decomposition cell

Copied from page 22 Voltameter record
Oct 9. 1878 W Cunningham

Carbon Resistance Aug 15. 1878

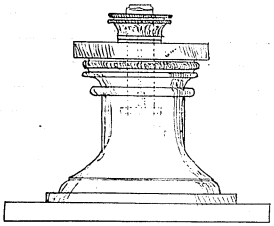


I wonder if would be a resistance Box to go from 1000 to 1000 it is necessary to have an dial arrangement like sample

Copied from Page 1 Carbon Resistance Record Oct 16 1878

M Carman

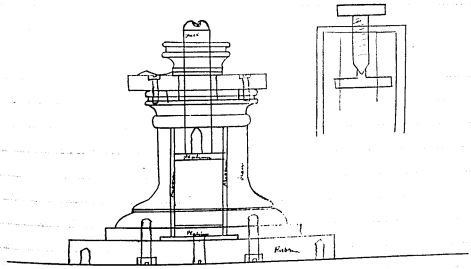
Carbon Rheostat Aug 15. 1878



Copied from page 2. C. Rheostat Oct. 16. 1878

M Carman

Carbon Rheostat Aug 16. 1878

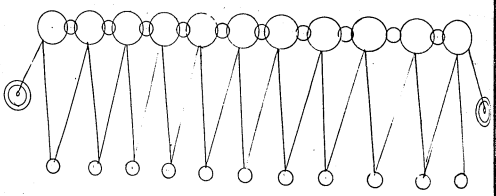


Copied from page 3. C. R. record Oct 16. 78

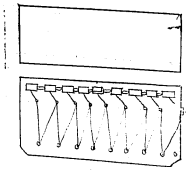
M. Carman

Fractional Rheostat Aug 26. 1878

Shunt for — Functional Balancing mirror & aluminum



20 of these Buttons



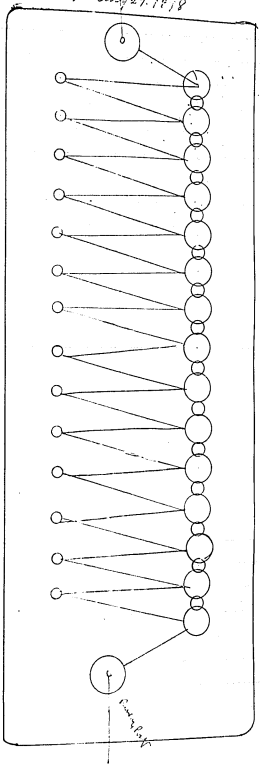
Shunt
Shunt
Shunt

Coiling Battery Button

Battery Button Balancing Shunt

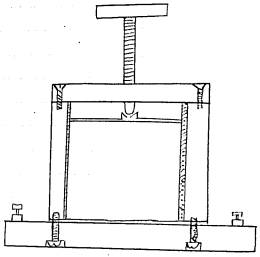
Copied from page 16 Rheostat records Oct 16. 1878
M Farman

Fractional Rheostat Aug 27. 1878



Copied from page 5 Rheostat Records Oct 16. 1878
M Farman

Carbon Rheostat Aug 31. 1878



Copied from Page 6. Rheostat records Oct 16. 78

W. Cannon

Edisons Carbon Resistance Sept 11. 1878

135 Plumbago Lamp test 2 on 3 foot one cell Gallond three cells taken on one ~~cell~~ balanced one on foot

135 discs	deflec 9	1340 ohms		Screw moved down 1/16
135 "	deflec 40	120 "		
1/2 67 discs	deflec 3	3760 ohms		Quad. Carbon Resistor
	deflec 46	60 ohms		
3/4 101 discs	deflect 3	3760 ohms		Copied from page 7
	deflect 42	90 ohms		Carbon Res Rec Sept 11. 1878
1/4 34 discs	deflect 3	3760 ohms		W. Cannon
	deflect 48	30 ohms		
34 discs same with 3 cells		4950 ohms		
		54 ohms		9520
				230

This one cell tests are probably unreliable owing to slight deflection

67 discs	deflection deflection	5400 ohms		
	" 69	67 ohms		120
101 ~~[illegible]~~ "	67	107 ohms	5400 / 4500 / 900	9850
" " "	54	6796 "		5400 / 6706 / 1306

Edisons Carbon Quad Resistance Sept 11. 1878

want to test it with pressure

discs used last night No 3 cells 1 cell Gallond Deflect 1/2 with pressure 34

No 1 make solution that will give 1/2 ohm and try it

water 4 oz		This test
Sectrum 1 oz		2 — 16 —
Plumbago 1/2 oz		

Water 4 oz		
Sectrum 1 1/2 oz		This tests
Plumbago 1/2 oz		1 1/2 — 22

Water 4 oz		This tests	This was rubbed off a little
Sectrum 1 oz 15 dwt		22 —	more than the last
Plumbago 1/2 oz			

Water 4 oz		
~~Sectrum 2 oz~~		This test
Plumbago 1/2 oz		15

Copied from page 8. C Res records Oct 31. 1878

W. Cannon

J. I.

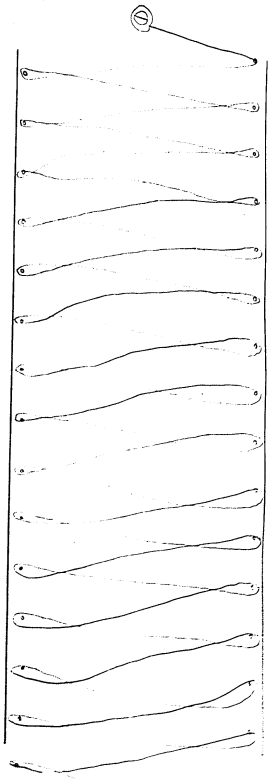
Echinus Cordatus Final Resistance Sep 6. 1878

Old		New			
1 –	23	1	220	80	260
2 –	57	2		1.40	
3 –	33	3		47	
4 –	17	4		326 x	
5 –	17	5	33	206 x	
6 –	24	6			
7 –	54	7			
8 –	58	8			
9 –	24	9			
10 –	28	10			
11 –	18 x	11			
12 –	28	12			
13 –	28	13			
14 –	30	14			
15 –	28	15			
16 –	28	16			
17 –	28	17			
18 –	18	18			
19 –	30	19			
20 –	28	20			
20)	581				
	29 Average alone				

10½ Sol. Number Sept 6. 1876
16

Copied from page 9 G. Rec Records Oct 21. 1878
W Carman

Fractionis Rhenstat Sep 11. 1878



Copied from page 10 Rec Record Oct 21. 1878
W Carman

Carbon Resistance for Quadruplex

3 cells Callaud Battery, Bradley Galvanometer No 1 coil

100 Plumbago discs	2 1/2 inches		
	9	4160	Sometimes 1/4 about
	7 1/2	2160	
75	6	9170	" " 1/3 "
	15	2320	
50	22	1600	1/2 mica tinfoil 5 free up
	48	1150	2 1/2 turns of screw
25	29	1153	
	52	373	3 1/2 turns of screw
75	7 1/2	1730	
	8 1/2	1170	

Turns for 18 hours
Sept 13. 1878
27 — 1640

Copied from Page 11 Resistance Record Oct 21. 1878
W Cunman

Carbon Resistance for Quadruplex Sept 13. 1878

20 Cells Callaud

75 discs of 2 1/2 Plumbago paper cloth made from standard

10 a m Sept 13

75 discs with pressure	75 squares	1440 ohms	
without pressure	62 "	2610 ohms	

tested on 3. Coil

75 discs with pressure	8 3/4	—	1440
	4 3/4		2840

3 Cells Callaud in one coil again

75 discs with pressure	24 1/2		1540
without pressure	11		2870

Take test at 5 hours after 3 P M

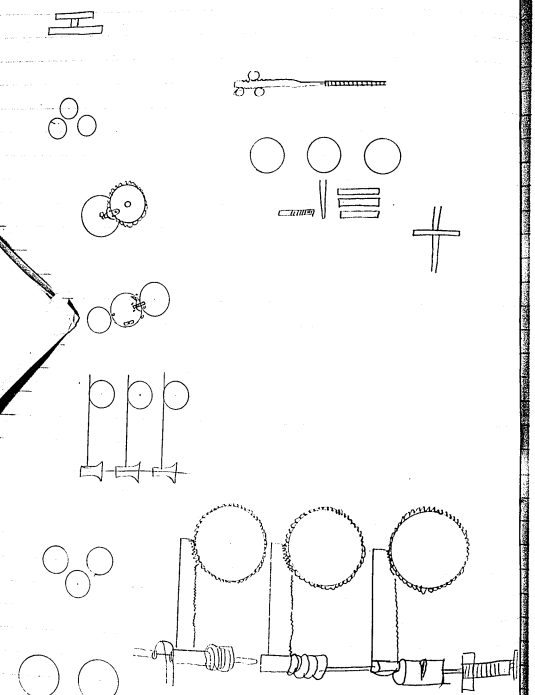
One coil 3 cells Callaud	25	1540 ohms	
	15 1/2	2690	
Cone 20 cells Callaud	73	1440	
	62	2770	
20 cells 3 coil	7	1400	
	5	2670	

3 P M Sept 14
24 hours after

24 1/2	1440
15 1/2	2640
74 1/2	1400
63	2690
9	1400
5	2670

Copied from Page 12 Res. Rec Oct 21. 78
W Cunman

Carlow Rheostat for Quadruplex Sept. 14. 1878

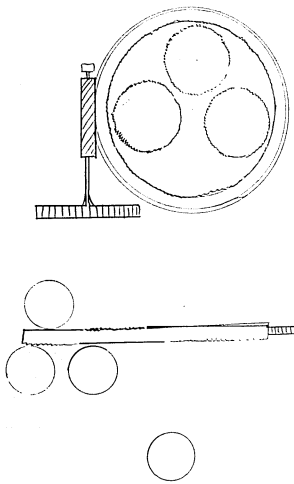


Racks worked by cams so that a set one goes no free distance before another commences and the last one starts back first

Copied from page 13 Resistance Records Oct 24. 1881

Mc Cammon

Carlow Rheostat for Quadruplex Sept. 14. 1878



3 cogs with pressure screws working inside an annular wheel provided with 1/3 cog which takes each wheel by itself and actuates it in same way

Copied from P. 16 Rheostat Records Oct 24. 1881

Mc Cammon

Carbon Resistance per Quadruplex Sept 16. 1878

After taking out the 75 discs and pressing each one amply and then altogether we took this test

		with Pressure		without	
3 Cells Each	1 coil	39 3/4	790	17	2390
30 Cells Each	1 Coil	52 3/4	720 ohm	6 1/4	2390
30 Cells Each	3 Coil	15 1/2	720	5	2390

Sept 18th

100 discs each pressed amply and then together

3 cells each and 1 coil

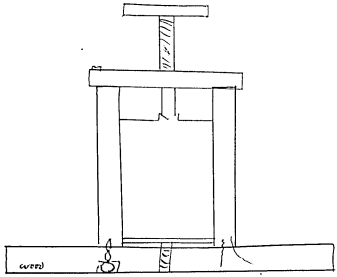
			with Pressures		without pressure	
	Dist Sept 21		35.	523	12.	3.70
20	" " "		35 1/2	523	10 1/2	4070
"	" "	22	75 1/2	770	11 4.	3900
3	" "	23	75 1/2	740	6 0	2.420
"	"		38	760	10 1/2	2490
"	"		14 1/2	764a		
"	"	25	37 1/2	803	10 1/2	1080
"	"	26	37 1/2	803	10 1/2	4080
"	"		39	1105	6.	6630
125 ohm	"		3.	1105	7	6100
		27	3.	1100	11	3720

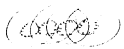
Continued from page 15 Resistance Records

Sept 21. 1878

W. Cameron

Carbon Resistance Sept 21. 1878





Continued from page 16 Resistance Record

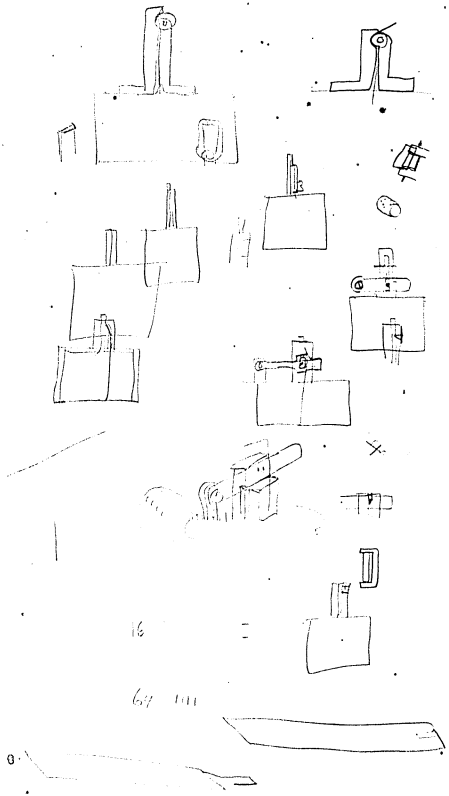
Sept 21. 1878

W. Cameron

E. M. G. Text-

640

Solution.



Experimental Researches, Vol. 5, Cat. 997

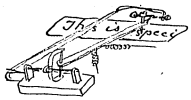
This notebook is divided into two parts. Pages 1-47 cover the period October 1875-January 1877 and deal with autographic and octruplex (acoustic) telegraphy, batteries and battery fluids, duplicating ink, applications for small electric motors, the electric pen and duplicating press, the mirror galvanometer, and the electromotograph. The descriptions are well illustrated, with detailed drawings of component parts and circuit diagrams. They are frequently signed and dated by Edison, Charles Batchelor, and James Adams. There are also several pages containing notes on new ideas relating to inventions such as an artificial fragrant rose, a pocket spectroscope, a flying bird, and an electric shear.

Pages 48-134 contain a series of illustrated caveats relating to various aspects of electric lighting and covering the period September 1878-December 1879. Many are signed by Edison. There is also one caveat for the telephone, dated 1879. On pages 171-173 is an undated, unsigned caveat or patent specification relating to telephone communications. The volume contains 640 numbered pages.

Blank pages not filmed: 136-169, 174-640.

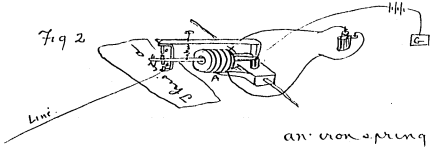
Autographic Telegraph

Fig. 1.



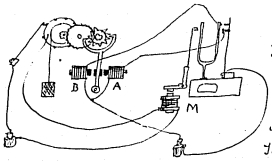
ink marks acting to increase friction moves a lever like the Electromotorgraph and opens an closes an electrical circuit.

Fig 2



an iron spring or lever b passing through a magnet or bobbin of wire, with battery attached, kept constantly magnetized, a gummy ink over which is sprinkled fine iron filings. The point on d comes very near the writing when it passes over a mark the iron filings act as an armature and attract it closing the line on the point d.

Fig. 3.



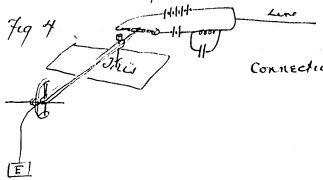
Tuning fork sending currents through A & B vibrating escapement with great regularity. Tuning fork kept in motion by separate magnet kept in motion at intervals by a break on last wheel of clockwork. Machines at both ends having forks vibrating same notes.

October 16th 1875.

Thos A. Edison
Chas Batchelor

Autographic Telegraph

Fig 4



Connections for transmitting

Instead of the ink acting as friction to move the lever and open and close the circuit the punctures made by the autographic press pen may be used the point catching in the holes carries the lever from point to point

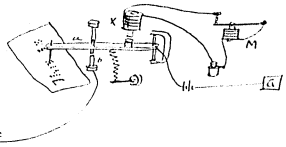
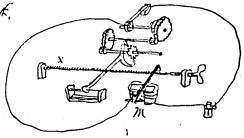


Fig 5

a is a lever vibrated with immense rapidity by the magnet X which is in a circuit with the self vibrating magnet M. or any rapid self Circuit breaker upon the end of a is a fine point which if there are no holes under it does not allow the lever a to touch the point b but when a hole occurs it enters it and allows the lever to touch b and close the circuit

Fig 6.



X. fig 6 is a pianoforte string making the smallest number of vibrations, in vibrating it works an escapement lever and release a tooth of the escapewheel attach movement allowing the Clockwork to move along with good speed and synchronous

with another machine with a like chord at the distant end The magnet M serves to give a constant vibration to X. it receives its breaks from a wheel & point on the slower moving wheels of the clockwork

Thos A Edison

October 16th 1875.

Chas Batchelor

Battery Fluids.

Try $KOCrO_3$ and $Ca-NO_3$.

Try $KOWO_3$.

Try KNO_3 5 parts SO_3 15 parts HO, 20 parts ✓

This gives NO_3. & $KOSO_3$ with probably less polarization than any fluid, especially $KOCrO_3$

Try ~~$KOCrO_3$~~ $HKCO_3$ 5 parts, (Bicarbonate KO) SO_3 15 parts HO 20 parts, Carb gas probably escape.

Try $KOCrO_3$ 5 parts NO_3 15 parts HO 20 parts

Try $KOCrO_3$ 5 parts NO_3 5 parts SO_3 15 parts HO 20 pts

Find a CrO_3 combined with an easily decomposed base for instance a soluble $FeCrO_3$ or other heavy metal.

Try NaCl 5 parts SO_3 15 parts makes chlorine Water The Electrolyte H will probably form with it HCl Immerse a platina plate in the porous pot of a battery connecting the same to the carbon and see if it has a tendency to depolarize,

Try some Muriate Calcium (bleaching powder) + in porous cell. probably H combines with loose atom Cl to form HCl.

Try Permanganate KO, 5 parts SO_3 15 parts HO 20 do makes manganese heptoxide. Mn_2O_7

Try $KOCrO_3$ 5 pts SO_3 15 pts NaCl. 5 pts HO 10 parts

Try Black Ox Mn 5 pts SO_3 15 pts NO 20 pts

Get some perchlorate of Potash!

Fuse Chlorate K until it boils and just as it solidifies stop take 4 parts add SO_3 16 parts then dilute makes perchloric acid one most powerful oxidizer known. use it in porous cell

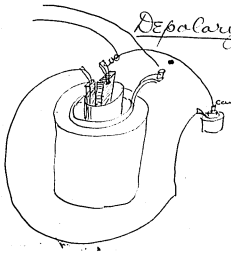
Use the 1½ batteries well cleaned for

These experiments became all bad resultants and
October 16th 1875

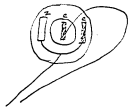
Thos A. Edison
Chas Batchelor

James Adams

Depolarization of Batteries



small depolarizing battery.



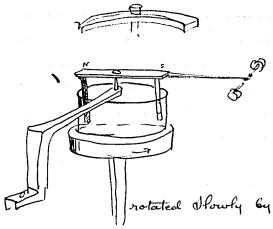
October 16th 1875

Thos A. Edison
James Adams

Battery Fluids

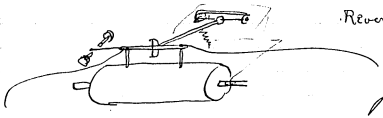
Try $KOCrO_3$ 5 parts SO_3 15 parts HO. "5" parts
Try $KOCrO_3$ 5 parts SO_3 20 parts no HO.
Try $KOCrO_3$ 10 parts SO_3 10 parts "
Try NO_5 alone —

Delicate Electromotograph

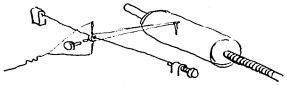


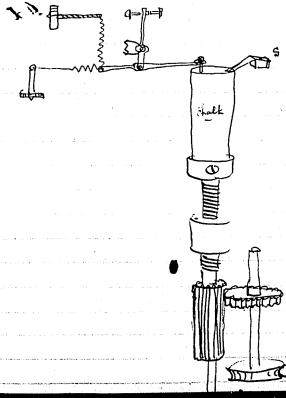
rotated slowly by an Electric Engine.

Aug 25 1876.
T. A. Edison
Chas Batchelor



Reverse Current EMQ
Aug 25 1876
T. A. Edison
James Adams





EMQ principle
S is a scraper which
cuts off the chalk off
Even as it rises —
this gives the second
point from a clean
fresh surface —

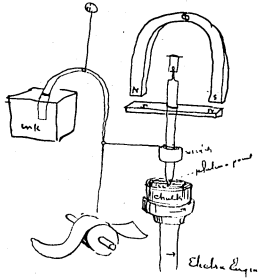
Aug 25 1876
T. A. Edison
James Adams

Electric Eng

Scheme for Autographic Printing.

Write on a sheet of paper with strong solution of Bichromate of potash, then have dry gelatine Coated sheet, slightly moisten these, then lay on Bichromated writing sheet press. This will transfer writing to gelatine sheet. Expose to light the will render part where Bichromate writing is insoluble, then Either wash & print by pressure of paper or by photo lithographic style.

August 28 1876 - T. A. Edison

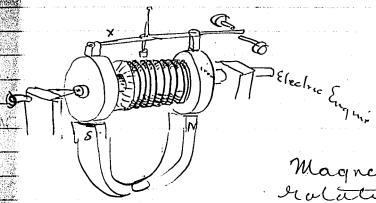


Lady Sporter Mutograph

Aug 28 1876
T. A. Edison
Chas Batchelor
James Adams

I found that if a glass tube is mounted on a bottle containing H_2S gas & the point of the tube drawn out very fine that H_2S passes all right but by holding paper wet with a solution of Plumbic Acetate point of the orifice the mark so obtained is to broad it spreads 1/16 even with very narrow orifice; tried holding little piece of Sulphuret of potash near lead paper but it dont give off enough gas; the pencil was rather old,

Aug 28 1876. T. A. Edison



Magnet Constantly Polarized =

placing the large permanent magnet where it is, is a mistake. The working bridge X should be polarized so that both ends should have the same polarity. This arrangement is a partial application of the EMF principle to a polarized relay. Aug 28 1876
T. A. Edison

I have an idea that an artificial rose could be made of such an nature that it would remain stiff and at the same time absorb by capillary attraction atto of Rose perfume from a bottle which is filled with it & which acts as the holder in the button hole;

Aug 28 1876 T. A. Edison

I have an idea that a cheap 25c pocket Spectroscope would sell on the street. The tube being cast in lead or tin, Canada Balsam used as a magnifier & common chandelier prisms broken in short pieces used for prisms.

Aug 28 1876 T. A. Edison
Chas Batchelor

I have an idea that the Electric pen could be attached to a stiff brass pantagraph and by such drawings made with it =

Aug 28 1876,
James Adams

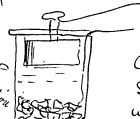
I have an idea that perforated stencil sheets similar to those produced by the electric pen only done by a stamping machine with larger holes representing outline stationary, landscapes etc could be sold in large quantities to Druggists etc to ornament mirrors windows etc by marking through the stencil with French Chalk; etc,

Aug 28 1876 – In addition book accompanied with Colors etc could be made wholly with a number of stencils any kind of a picture could be produced, & these books sold to the trade to be used for Educational purposes & for amusement,

Aug 28 1876. T A Edison. Spoke of this one 8 mos ago.

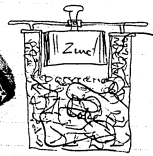
Battery.

Edison's Patent No 4 for reduction of Copper



I used coke which is a fair Conductor & very porous and string the pieces on a Copper wire so that the coke is Electrically Connected together and mixed in with the pieces are the crystals of Cupric Sulphate. The Coke soon becomes plated with Copper owing to it porosity gives an enormous surface

I propose another method thus: —

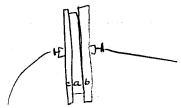


I use a porous tube open at both ends in which I place the Zinc hence I am enabled to place the Coke from bottom to top and near the zinc,

Another method is to place a disk of Copper at the bottom and fill in granulated Copper head,

Aug 28 1876 T A Edison

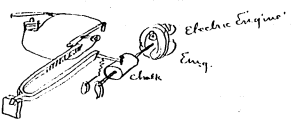
Powerful inexpensive Condensers



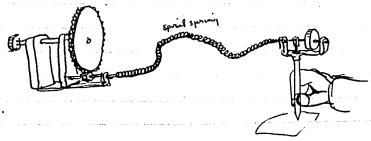
Aug 28 1876 =

T A Edison

a & b are platinized disks, a is a block of chalk or other porous substance saturated with polarizable chemicals such as Caustic Soda. (Edison.)

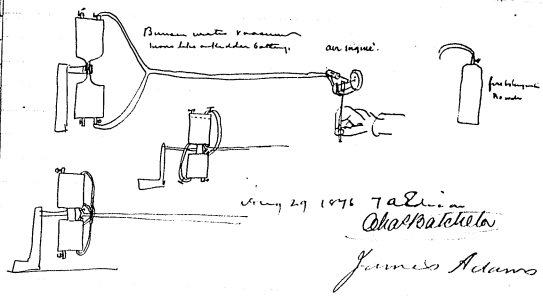


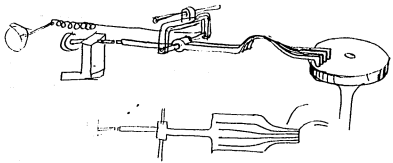
1st Acoustic Telegraph I propose to use a number of tuning forks upon the ends of which are lines resting up revolving Chalk cylinders maintained with a chemical solution, and so arranged that the Emery principle sets the fork in motion, one simple cylinder may be used to set several forks in motion, Aug 28 1876 T A Edison.

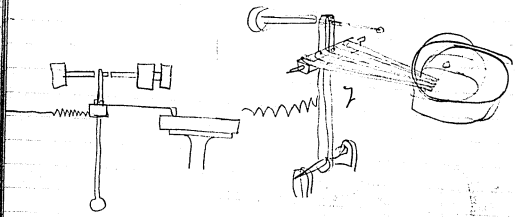


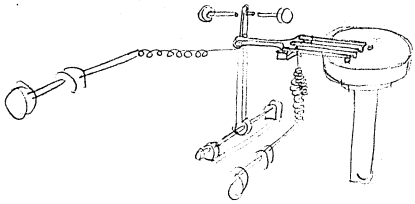
Method of working the perforating pen by flexible Spiral Spring

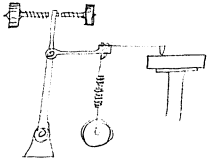
Aug 29 1876 Edison

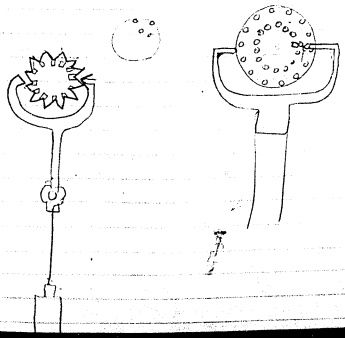

Bunsen water pressure
can inquire.
Chatkatchela
James Adams

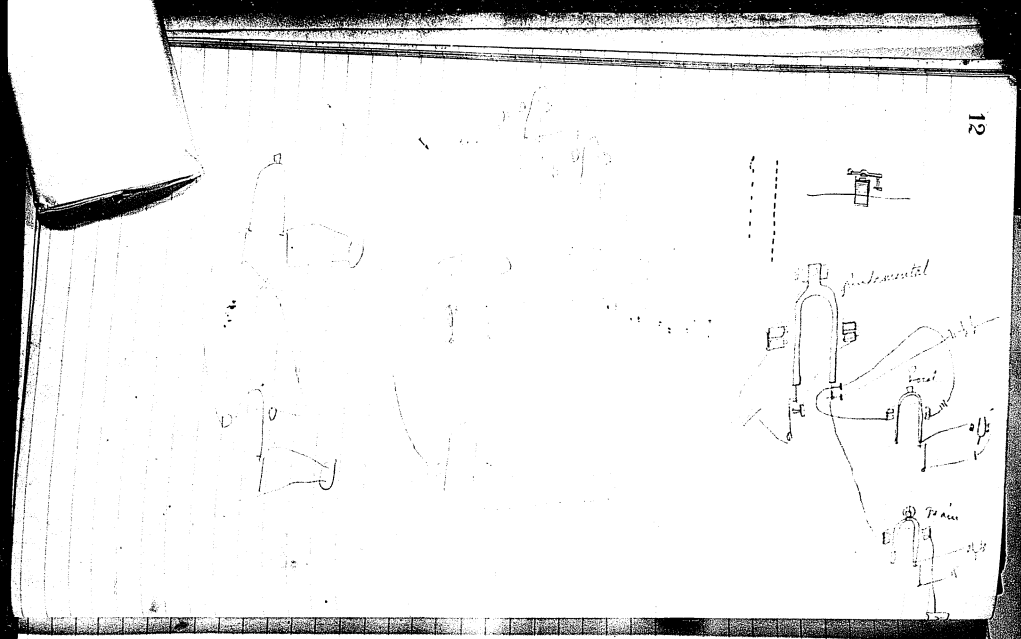






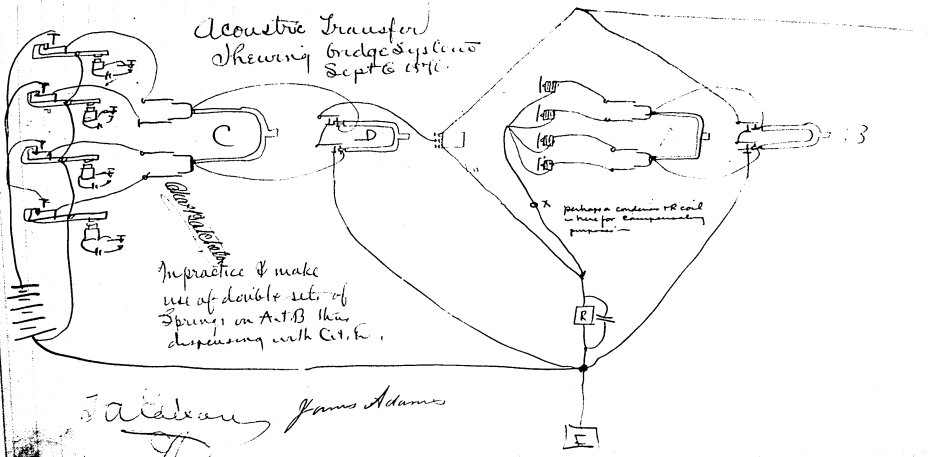






Octruplex

Acoustic Transfer
Showing bridge system
Sept 6 1876.



In practice I make
use of double set of
springs on A & B thus
dispensing with C & D.

Alexander Graham Bell

James Adams

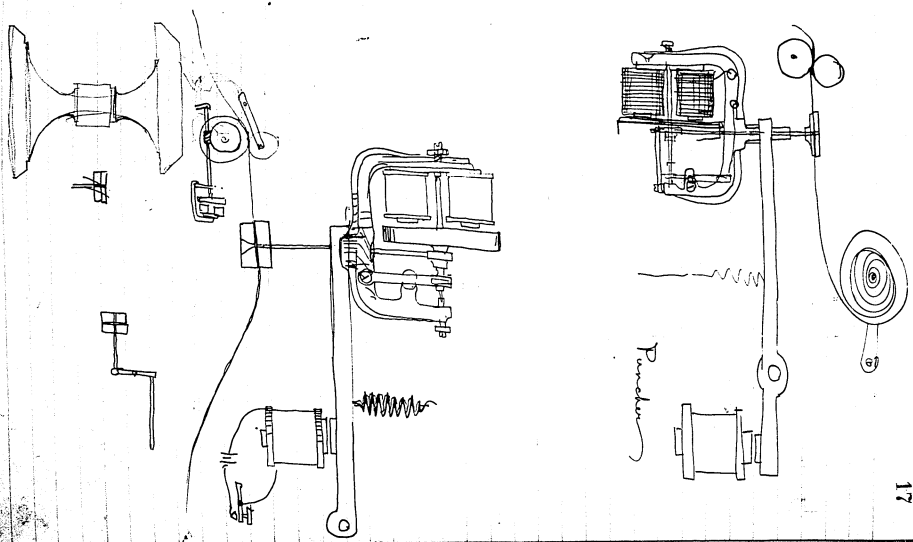
E
E
E

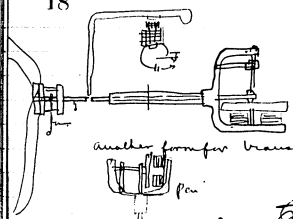
Electroplex
Cutoff principle
with Bridge System
E
James A. Adams
Sept 6 1896.
Witness
Witness

New system based on the Electromotograph. first. I propose to use Morse registers or other means such as a magnetic engine to move the strip of paper along and I arrange a single punch & mechanism on the lever of the register which is moved by a magnet in a local circuit operated by a key. The little punch is vibrated with immense rapidity in the same manner as the needle in the Electromotograph & the whole is so arranged that when a messenger is sent on the key the lever will bring the punching device in play & punch holes in the paper instead of embossing the characters as when the registers are used in the ordinary manner. The punched strip is then taken to the transmitter which consists of a pelton wheel drum rotated by suitable machinery & the paper passed rapidly through it & the contact roller serves to open & close the circuit & transmit the characters to the distant station.

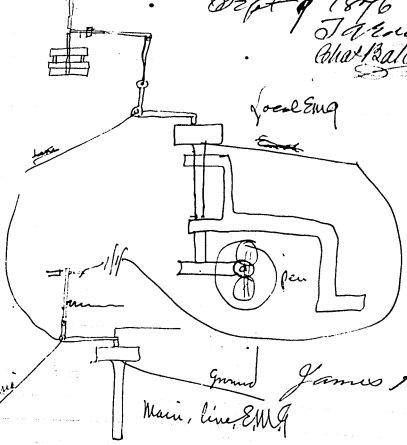
The transmitter consists of the lever of the Electromotograph, which corresponds to several hundred words per minute. This lever opens & closes the circuit of a local battery & local Electromotograph whose lever moves with great force. This second lever serves to bring into play a perforating tool similar to that employed in preparing the transmitting strip. The reproducer the messenger on a strip perforated, the strip is then passed between a point & drum rotated slowly and connected to a sounder & the operator copies the message by sound.

J. A. Brown Sept 4 1876





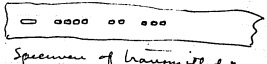
another form for transmitter pumicher



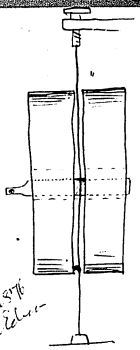
Sept 9 1876
T A Edison
Chas Batchelor

local EMG

James Adams

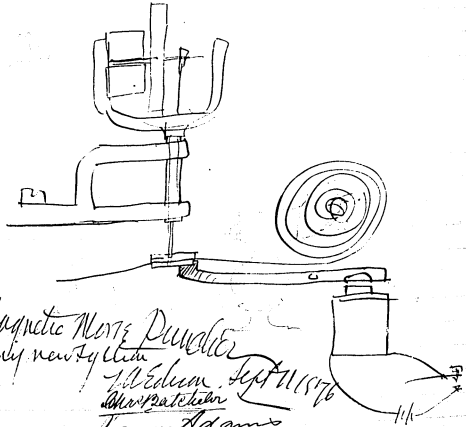


Specimen of transmitted & reproduced perforation

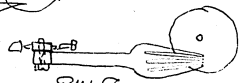


Sept 15 1876
T A Edison

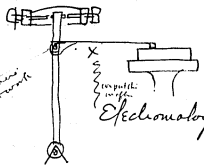
Memory alexanometer spools with thin sheet steel needle having great deflection force and adjusted by forming another extreme end in a platinum plate or point playing ~~[illegible]~~ in between contact points. & by putting a condenser in line, and sending reversed currents the reversing reversers currents are substituted to work the needle tongue with great rapidity and thus enabling me to separate my signal signals from mere automatic current into another



Magnetic Morse Duplex
formly neutral system
T A Edison Sept 11 1876
Chas Batchelor
James Adams



EMG



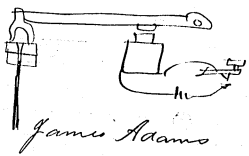
New style lever we are putting on today.

Sept 11 1876

TAE

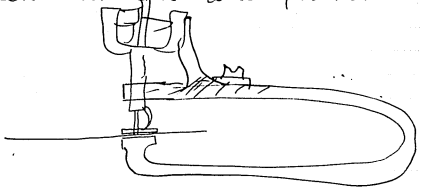
Solution for EMG
Pyrogallic Acid & Acid
Caustic Soda
Caustic Soda & Gum Gamboge
Caustic Soda & Acetate Mercury
Other Caustic Alkalis & Acetate Mercury.
Ferrocyanide Ferricyanide & Acetate Lead
Caustic Alkali & Balsam Copaiba,

Sept 11 1876 T A Edison



James Adams

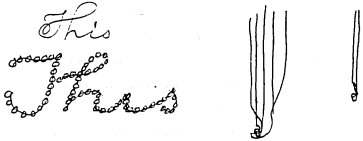
I propose to use a panlagraph movement for preparing messages for Autographic transmission in this manner — I secure to one prong to a panlagraph an Electric pen with die arrangd thus



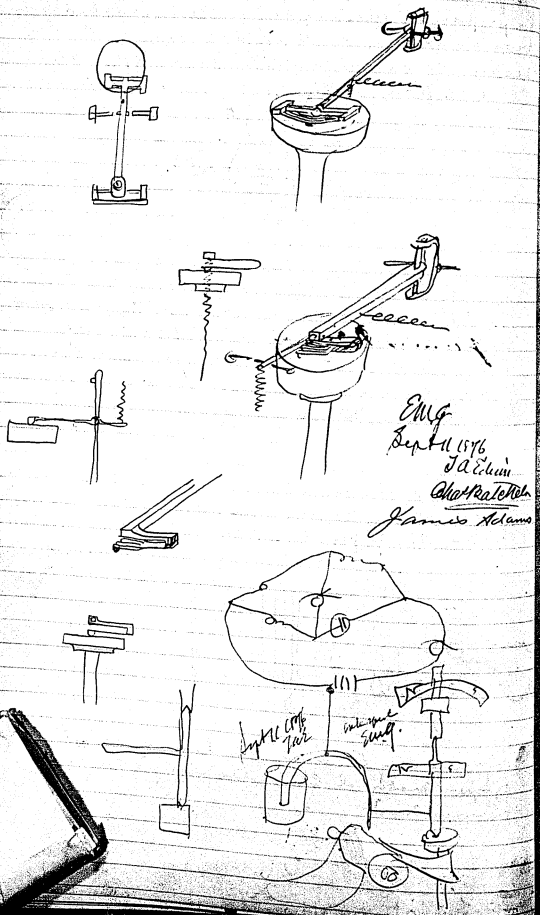
so that when a person writes with the lines cutting the pencil the pen & die with move with it and produce the Copy enlarged 3 or 4 times in perforations which can then be transmitted with Ease.

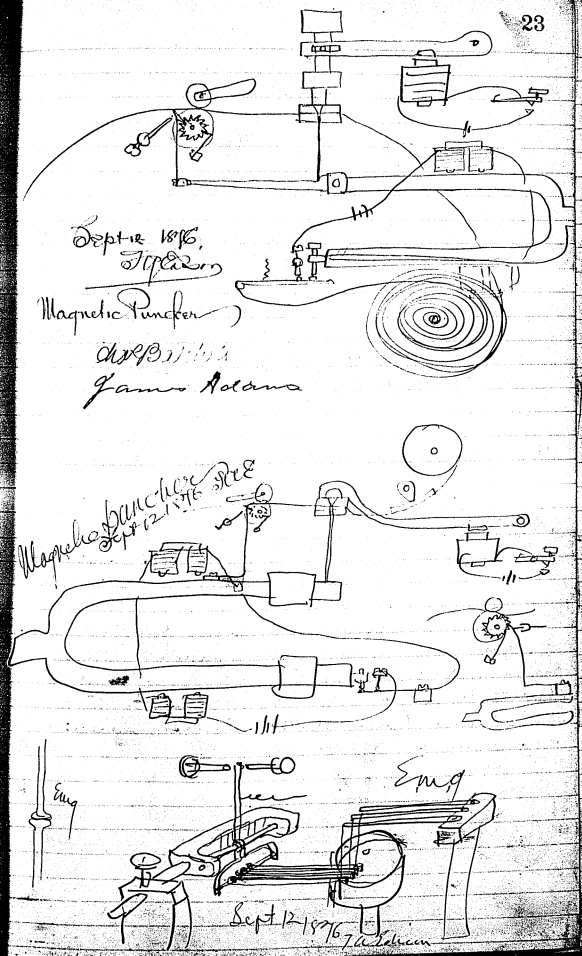
Sept 11 1876 T A Edison

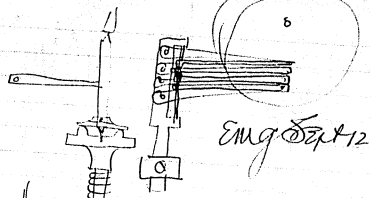
Another method is to make the end of the needle of an electric pen larger & punch like a cutting punch thus James Adams

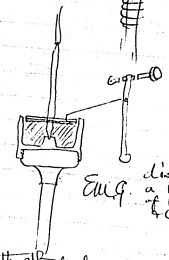


by using very thin paper & laying it on thick paper material the holes could be easily punched —


Emg
Sept 11 1876
T A Edison
Chas Batchelor
James Adams
Sept 11 1876
T A E
Emg.


Sept 12 1876.
T A Edison
Magnetic Puncher
James Adams
Emg
Sept 12 1876 T A Edison

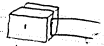




We now place a pad of Soft Bolting cloth on the disk of the EMG Cover it with Dick & wet. This is the best yet found =

Worth Paul today in making a Compact Magnetic puncher.

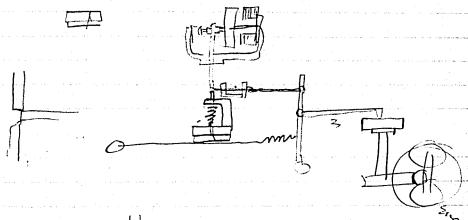
Sept 15th 1876

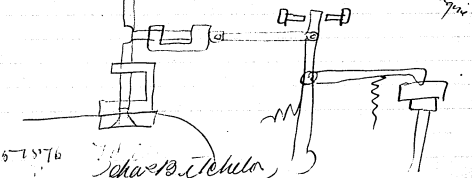


die for magnetic Engine puncher

I propose using instead of a round punch a square Edge punch in this shape actual size ~~M G~~ about 1/32 high & ▯ about 1/16 thick this will make square holes & dashes because it requires much less power.

I shall use if possible the main line EMG to set in motion direct the repuncher thus

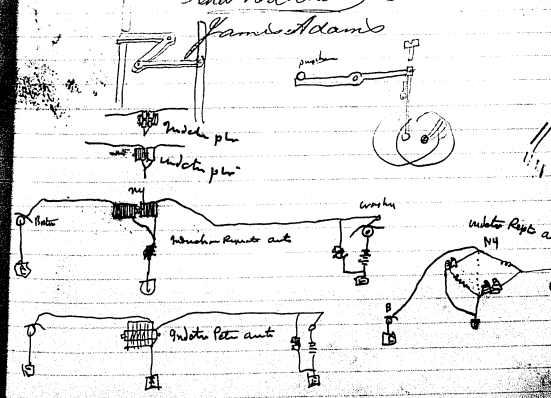


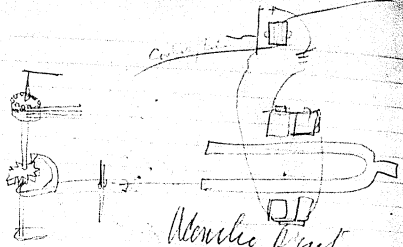


Sept 15th 1876

Chas B Nichols

Frank Adams





Electric Fuse

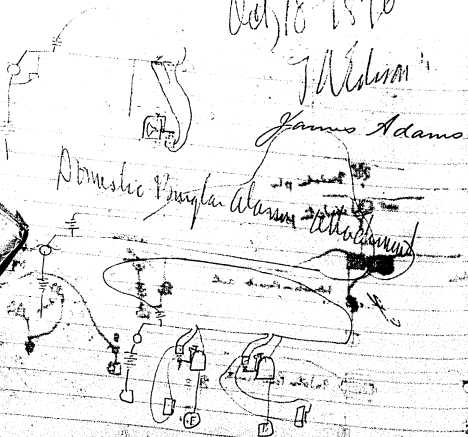
Oct 10 1876

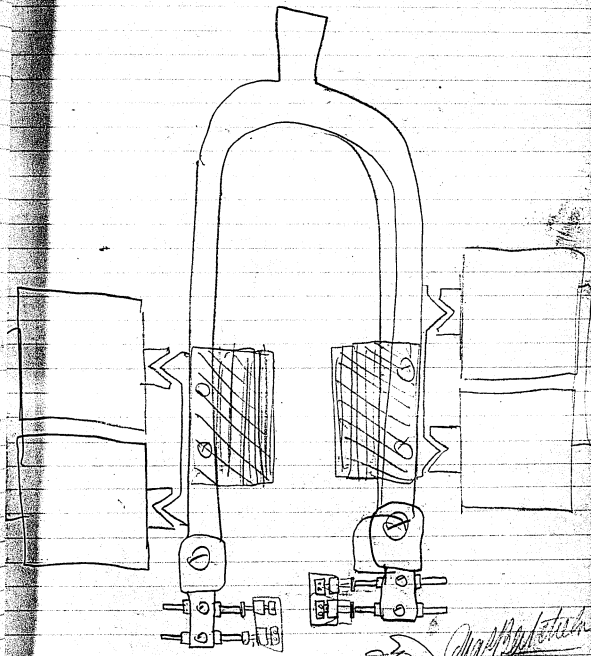
J. Adams

James Adams

Domestic Burglar Alarm

Attachment





James Adams

Witnesses
Chas. Ashton
Geo. Ashton

Inventor
James Adams

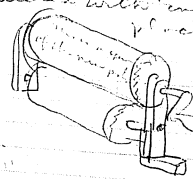
Frame
Working Contacts closed
Frame
Chas Batchelor

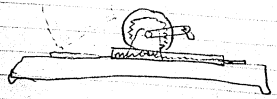
Chas Batchelor
Frame Adams
Electric Sewing Machine
Sewing foot applied
to drive machine which
feeds extra motion by
electromagnets
Oct 16 1896
Wm Mills
Wooden wheel Guards
Frame of sheet iron
Brass Bearings
Cast iron Frame
Wooden wheel Guards
Wm Mills

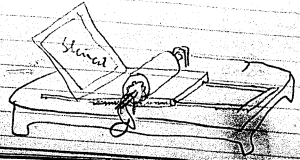
If the switching forks are worked direct on the Cutting lever, duplex, it will probably be necessary to add a Condenser shunting a Rheostat or bridge wire to weaken the Effect of the Sliding Change otherwise one fork will hug on the other & change the currents =

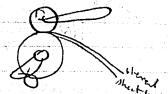
Idea has occurred to me to arrange two needles with Elastic eye one having an eye at the end with a thread the other pointed with a hook so that by passing pin over Cloth stretched it will make a loop which then allowing beautiful Embroidery etc to be made at high speed =

Sketch Copying Process felt Roll saturated with ink over which sheet is passed pressure by heavy roll cranked in = The rollers are geared or otherwise fastened together & paper is passed between them





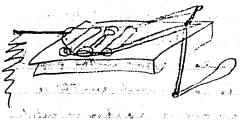


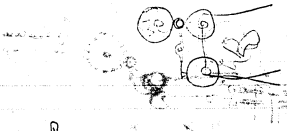


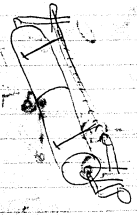
Oct 18 1876.

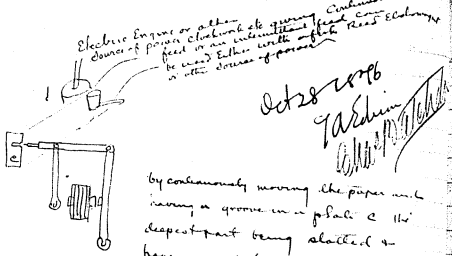
Chas Batchelor

James Adams



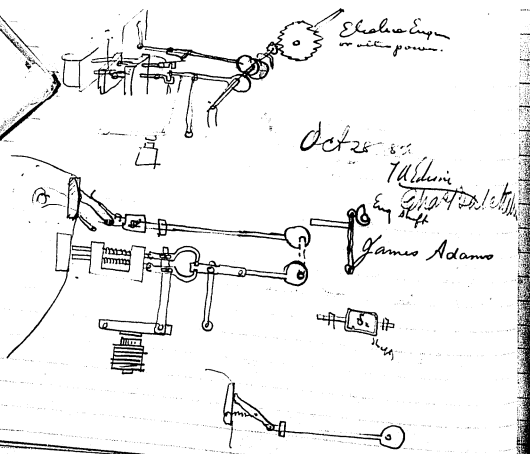




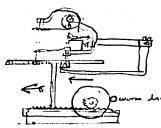


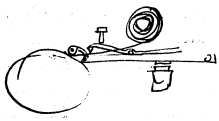
by continuously moving the paper and having a groove in a plate c the deepest part being slanted & having an embossing point have a knife on it & a cam and it

Emboss & at the same time cuts a slot with paper in horizontally the central lever is provided with a Knife Edge point and the Emboss or rather indentation as I prefer to use the ~~make~~ latter guides the point & it by pressure drops into the indentation & through the slot allowing its end to touch a contact point thus closing the circuit



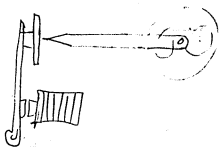
I propose to arrange the punching and feeding devices in such a manner that I can punch the messages on a Continuous Circuit like the record of a Bain chemical disk. Starting the message 2 inches from the centre & thence outward I can use a square blank & this will be very convenient for handling. The disk may be revolved by one of the Eccentrics on the motor feeding it around step by step, and the other carrying the disk secured to a movable slide is moved continuously by another motor.





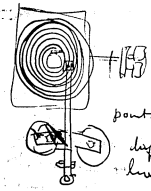
idea is to have rolls of tin foil, 1/8 strips wide. and form characters by forcing it down on pasted paper by magnet

~~Stroke~~ Keeping clamp allows foil to run out from roll & pasted to roll but when lever raises brush foil & again allows it to run out when closed again =



Oct. 26 1876 T. A. Edison

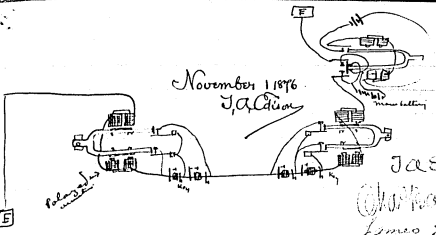
— ·· — ·· — Electric pen large needle dots + dashes formed. Moment of hand full thickness paper clear sounder + chemical fluid of the dots which turn + open circuit + Rem points.



Embossing

dog plate for feeding the pointed lines out

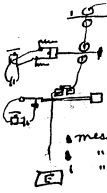
James Adams



November 1 1876
T. A. Edison

JAE

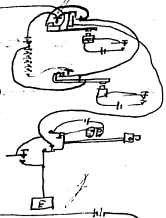
James Adams

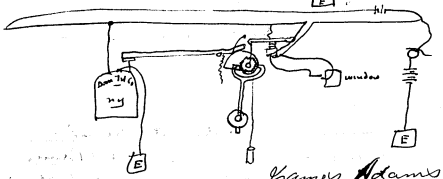


November 1 1876
T. A. Edison

you can Duplex. Sp's.
make .6.

message by reversals
" by increase + decrease
" by acoustic vibrations

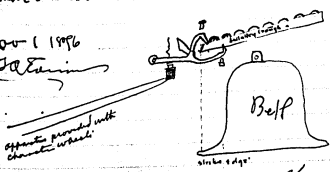




James Adams

~~with~~ burglar alarm circuit closers on windows of a house ~~control~~ short circuits magnet + chest release button pushing mechanism which is so arranged that the cord is just long enough to depress button 4 times more or less.

Nov 1 1876
T. A. Edison



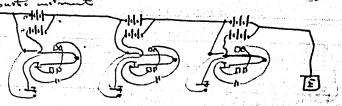
opposite pointed with chemical which

Tower Bell strikes for fire or Telegr.
Common bells released at proper instant by a magnet

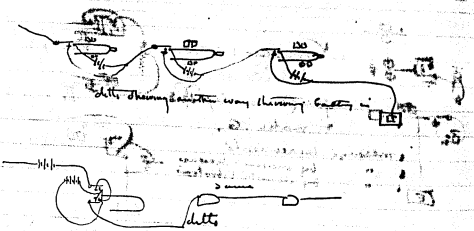
James Adams

Nov 1 1876 T A Edison

to distant acoustic instrument

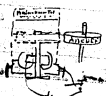


acoustic transmitters, each making different note



Throws in a multiplying battery to right multiplyer to left Double strength = [illegible]

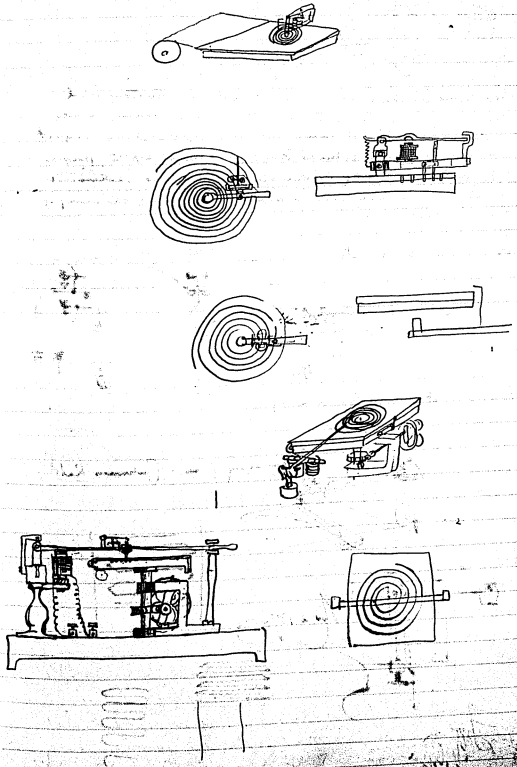
Nov 1 1876 T A Edison



Continuous Printer. Method of putting strips on WU Blanks

Everytime you print letter it [illegible] parts on strip you can see [illegible] have to punch [illegible]

I propose now to emboss the messages for transmission by having the blank stationary on a revolving spiral block the blank being held down by another block with revolving spiral grooves cut clear through



Perforating

Emy. Internal interrupter cut of Emmy = perforator

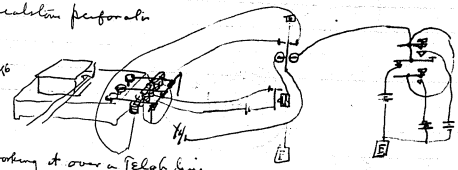
Nov 2 1876
T A Edison

James Adams

Reference

doubled up platina wire kept white hot by a battery and connected to a magnet operated by a Relay or key or direct on a Telegh line. The closing of the magnet serves to bring White hot platina up to paper & burns it, which the length of which is determined by the continuous moved paper, & length of closing of the magnet =

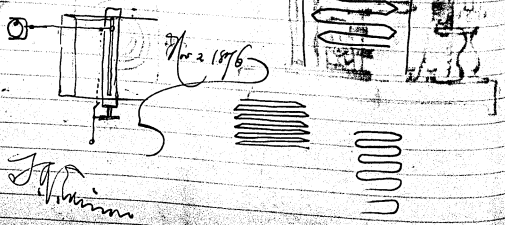
Wheatstone perforator



Nov 22 1876

for working it over a Telegh line.

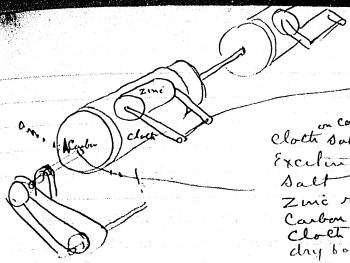
Embossing from Gutenberg Roll—



Nov 2 1876

T A Edison

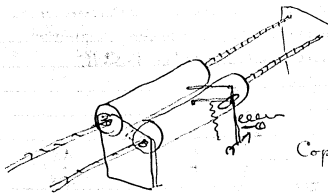
Galvanic battery



on Carbon Roll.
Cloth saturated with Exciting Solution & a Salt Hg. rotated.
Zinc roller & or vice versa, Carbon roller + zinc with Cloth on = object semi dry battery - no polarization

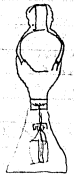
Nov. 6. 1876, T. A. Edison

James Adams



Copying machine.

I propose to write the letter etc with an ink that will give great frictional surface; place it on a drum provided with an EMG lever, on the extreme end of which is a fountain pen opposite another roller with the paper on for receiving the copy the ink marks by their friction move the EMG lever. Cause it to bring the fountain pen against the other paper at every mark the Cylinder revolves by gear & are fed endwise by any or both devices such as a ratchet, worm - screw, the whole thing may be rotated by pen electric engine, Clockwork hand power foot, or any source of power or a tuning fork, or an Motion by magnet = I can use a stylus, & put carbonized paper over recorded paper & receive the copy on the ordinary EMG lines. This is Expeditious Copying — Nov 6 1876 T A Edison

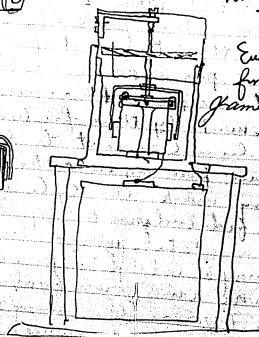


Lamps

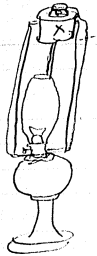
I propose to replace the clockwork fan blowers of Kerosene lamps that work without a Chimney by an Electric Engine for the purpose of working a fan, which engine is to be run by a Cell of Battery inside the base of the lamp: for this purpose I prefer to use a sealed Leclanche Cell.

Nov 15 1878
T A Edison

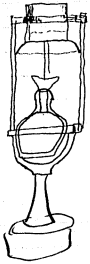
Nov 15
1878 T A Edison

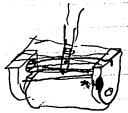


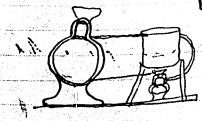
Engine Blower
for Lamp
James Adams

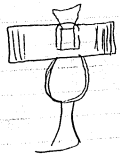


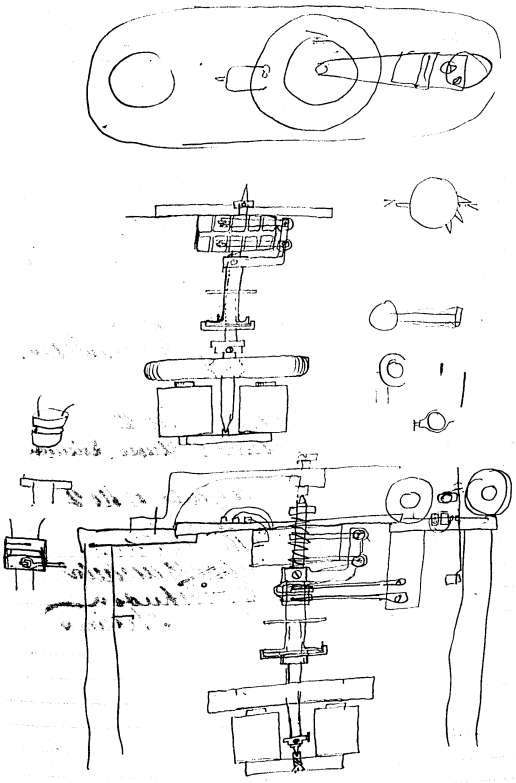
I utilize the heat of the lamp to set free oxygen gas from the Chlorate K + MnO3 in the Metal box X, the gas is conducted to the burner by means of the tripod of tubes & it is natural enough that the chimney is used as the source of O x that will take care of the Carbon & there will be quite a draft.











Edison's Duplicating Ink

On the 1st day of December 1876 or thereabouts Edison compounded the following ingredients to form a new copying ink:- Aniline Violet, Alcohol and Gum dextrine in the proportions as mentioned below. We find it superior to anything in the market it being able to do the following:- A copy can be taken on letter press paper & from such copy numerous copies can be taken on letter or other paper. A copy can be taken from such copy at any future time - The following are the proportions to manufacture this ink:-

2 galls & 1 pint of Alcohol
5 lb 5 oz of Aniline Violet
4 Galls & 1½ pint of Water } No 1 Solution (Stain).

20 ¼ Galls Hot water
21½ lbs of Gum dextrine } No 2 (Stain. Solution)

1 Gall of No 1 to 4 Galls of No 2 and stir well before bottling

Dec 13th 1876

Thos A Edison
Charles Batchelor
E. N. Johnson
James Adams

Proposed application of small electric Engines, some of which I have already experimented with, and am now engaged in experimenting with.

Flying Bird, composed of hollow core iron magnet, paper wings and self vibrating break, with a homeopathic vial attached containing zinc highly amalgamated & carbon - using strong bichromate of potash, the idea being that it will fly a 1000 or more feet high & a considerable distance, according to the strength of the battery & its lasting qualities. Object. a pleasing scientific toy & perhaps it might be used for carrying communications short distances with proper windless &c.

Electric Shears for cutting cloth, paper, tin foil etc consists of a rapidly revolving sharp edged disk against & a little below a straight edged presser foot.

An electric Engine, portable like Electric Pen with vertical revolving shaft holding a diamond pointed tool - it may vibrate up & down like the pen & the diamond cut the Shield Blank - for Engraving on glass

An Electric pen on a pantagraph - also the Engraving Electric Engine.

A portable Electric Engine with double needle one showing thread through cloth & the other passing through & hooking it pulling up a loop for Embroidery

An Electric Engine with worm & worm wheel for revolving the Lenses of a Calcium light Also for Revolving show goods in Windows Also for Working Morse Registers

Ideas

Dental plugger –

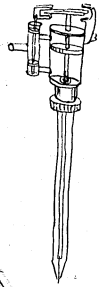
Make a ribbon of glycerine & aniline for elephant for type writer for duplicating.
Try Chl Zinc Dexter's Aniline which is poly basic

Get up a brick for carbon paper & soak the tissues of paper let the ink be the same

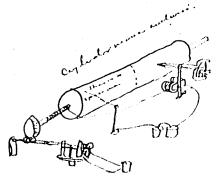
Electric Vibrator or Engraver to give a down forward & upward motion to a graver for Engraving

Gary Stamping

Adams



Pneumatic Pen

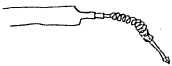


Jany 9 1877

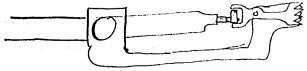
E. Engraver runs cylinder. Electric pen on one end control point at other – you work on cylinder or on lin. fact. & its "stencilled" by Electric pen –

Electric Engraver

fathers attachment to portable



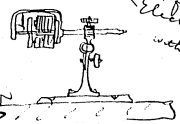
flexible tool & go adjustable of portable Electric Engraver



Horse Clipping attachment to Portable Electric Engraver –

Stand for portable Electric Engraver with background.

Jany 9 1876 =



H Edson
Edward Scholes

Menlo Park N.J. Sept 27. 1878

The remainder of this book will contain Caveats alone

Wm Carman

Caveat for Electric Light spirals

The object of this invention is to produce light for illuminating purposes by metals heated to incandescence, by the passage of an electric current through them, a great number of pieces of such metals forming part of an electric circuit, and distributed at various parts of the same

The invention consists in devices whereby the heat arising from the passage of such current is utilized to regulate the temperature of the incandescent metal which serves to give the light so that it is never allowed to reach its melting point, now matter how strong a current attempts to pass through.

Heretofore strips, thin wires of Platinum, Iridium and other metals have been included in the electric circuit and the passage of the current through them has brought them to a state of incandescence thus giving light but a careful regulation of the strength of the current is necessary otherwise the wire will either be melted or fall below a temperature necessary to give a good light.
My invention is adapted to overcome this constant watchfulness and causes each spiral to automatically regulate its own temperature. I shall describe many variations in the devices which I am now - which I propose to experiment with ——

Fig 1 is a magneto electric machine supplying currents to a circuit 2 — 2.
R.R.R. etc are resistances placed in the circuit at any point where a light is desired. the resistances allows of a portion of the current going

shunted through a metallic spiral wire sheet or other conductor which is to be made incandescent:
In figure 2. as shown on form of electric lamp
a is a platinum or iridium wire (it may be made of any metal or conductor having a high melting point or be made in a form of a wheel or solid spiral)
b is a rod preferably of zinc or other expansible material and this is secured firmly at B and passes through the centre of the spiral a. It connects at the other extremity with a lever 5 and serves to give a downward motion to the same when the rod 6 is expanded by the heat of the spiral on the end of the lever 5 is a platina point which in its normal position rests against the platina pointed screw 7 - H is the frame of the instrument and is of metal, the current passes through wire 1 to the rod (insulated) 2 thence down the spiral to the rod 5 and frame H thence to the screw 7 to wire 8 back to the resistance R. The resistance of the latter is such that it allows of a powerful current to pass within this derived circuit heating the spiral a to incandescence as the spiral approaches its melting point the rod 6 expands and carries the rod 5 away from the screw 7 and so no the circuit. the temperature of the spiral immediately falls as well as that of the rod. 6. when then contacts and causes the lever to again come in contact with the screw 7. and the spiral again approaches its melting point. the lever 5 which is springy or rather elastic is so adjusted in relation to the screw 7. that without so degrees of temperature of the melting point of the metal of the spiral a. the lever leaves the screw, hence as matter what amount of current is used the heat of the spiral acts upon devices to regulate its temperature and prevent ration hence an excess of current sufficient to fuse the spiral improvided with the regulator may be used necessarily.
In fig 3. as shown another modification in this case the connections and operation is the same

except that the expansion of the spiral itself is used to give motion of the lever 5.
In fig 4. The circuit is arranged in such a manner that when the lever 5 is thrown downward by the expansion of the rod. 6. It comes in contact with the point 7. and forms a second derived circuit thus weakening the current in the derivation containing the spiral and reducing its temperature
In figure 5 the operation is the same except the expansion of the spiral, itself gives motion to the lever 5.
In figure 6. a glass tube d passes through the centre of the spiral - a. through this tube passes the expanding rod 6. The operation is the same as in figure 4. but it is a more convenient device.
In fig 7 is shown the wire to be rendered incandescent coiled in the form of a volute spiral the inner end secured to a shaft. C the other end to a permanent fixture. m. the shaft has a lever J which approaches or recedes from a platina pointed screw H. when the temperature rises or falls. Its operation is the same as fig 5.
In figure 8 The expansion of the rod 6 and downward movement of the lever 5 places in the derivation containing the heated spiral a. an extra resistance R' which lowers its temperature by weakening the current —
In fig 9. a is the spiral. m two strips of metal fastened together a being steel and B zinc (any two substances one of which expands more than the other may be used) These are placed in close proximity to the spiral. in their normal condition B is in contact with the screw 6. and the spiral a is heated when it approaches its melting point the strips bend out and connection is broken between B & 6. the spiral cools and B comes again in contact with C and so on —

In figure 10 the operation is the same except that the circuit is not entirely broken a resistance R' being included in the circuit which is separate from C.
In figure 11 the expanding rod b. gives motion through a compound lever b a cooling bar B. which approaches and cools the spiral as the rod b expands.
In figure 12 a double strip. M. secured at X expands and approaches. and cools the spiral a as ~~just~~ its temperature rises.
In figure 13 an electro magnet. M. replaced to receive a current of little less strength than would melt the spiral is included in the shunt with it. hence when the current is increased from any cause to melt the spiral the circuit opens.
In fig 14. shows the same thing except the magnet is included in a permanent derivation
In figure 15. the magnet M instead of entirely opening the circuit throws a resistance R' into the circuit to weaken it.

In figure 16 a thermo electric pile X is placed in close proximity to the heated spiral the current from it activates a magnet M whose lever M and point O opens and closes the shunt containing the spiral a, when the temperature of the spiral becomes too high the current generated by the thermo pile. causes the magnet M to attract its lever and then the derivation of the spiral a. its temperature decreases the thermo current weakens and the lever M ~~comes~~ in contact with O and so on —
In fig 17. the lever G of the magnet closes up the spiral when the current increases.
Fig 18 shows the expansion rod b throwing in resistance R' R² R³ on its downward motion. thus weakening the current.

In figure 19. a sheet of platina or other substance is used for giving light by the passage of the current. hung to the bottom is the lever 5 carrying a large weight X on its extreme end. In its normal position the point on X is in contact with 7. but when a becomes too hot its expansion is sufficient to separate X from 7 and it immediately cools only to make contact and break the circuit again —
In fig 20 - a magnet. M. similar to an ordinary duplex transmitting sounder is included in the derivation when the lever is unattracted the spiral a is in circuit through the lever e and spring. C. when the current is increased from any cause the magnet lever is attracted throwing a out of circuit and bringing in a resistence R' (equal to a) in circuit. this device is not strictly a regulator but is only useful for experimenting where it is desirable to have some device to prevent destruction of the spiral
In figure 21. C is a button of finely divided conducting matter that varies its resistance by pressure. This button is placed between two metallic armatures a x B. - D is a lever which is pressed down upon the armature B by the spring E aided by the screw g. X is a rod of material quite expansible by heat this is secured permanently at the top and rests upon the lever D at the bottom. F is the platina spiral. The current passes from wires 1 to the armature a. through the button to 6 thence through the lever d to the spiral F out again. when the spiral is heated by the passage of the current the rod X expands and decreases the pressure of the lever d on the button. resistance is put in circuit by this lessened pressure and the temperature of the spiral decreased. hence by adjusting the rod X and spring e. the spiral may be brought to any required temperature,

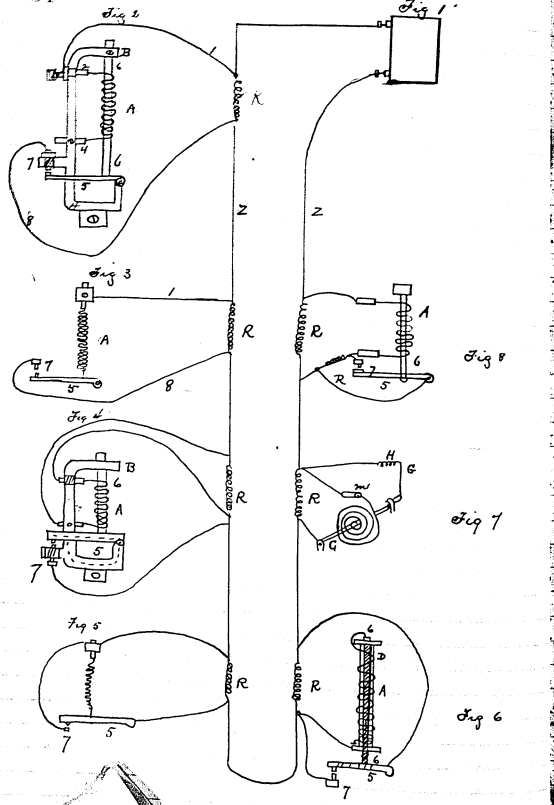


Fig 1
Fig 2
Fig 3
Fig 4
Fig 5
Fig 6
Fig 7
Fig 8
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B
R
Z
K
H
G
M
1
4
5
6
7
8

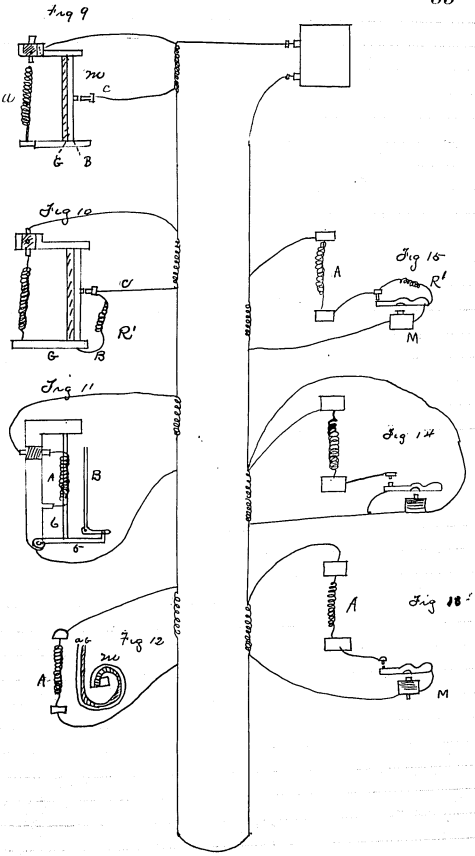
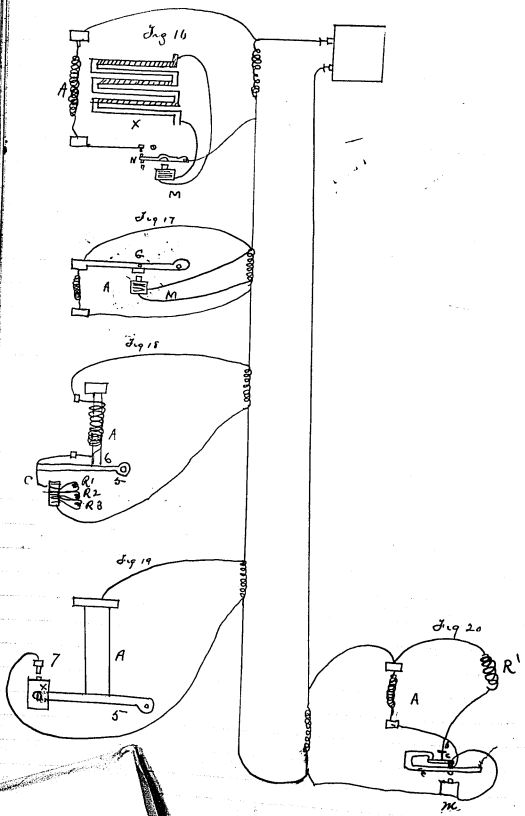
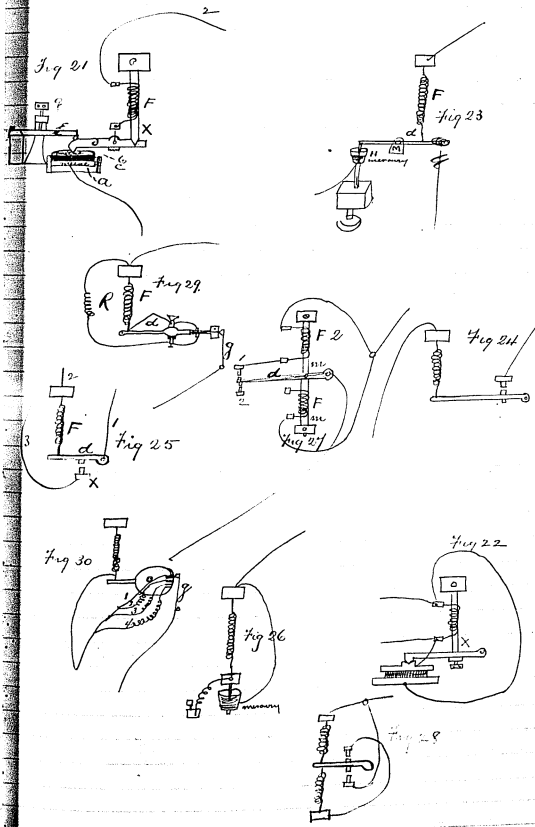


Fig 9
Fig 10
Fig 11
Fig 12
Fig 13
Fig 14
Fig 15
Fig 16
A
B
C
G
M
R'
m
w



Extension of Caveat for Electric Light Spirals



Extension of Cancel for Electric Light Spirals

Sept 13. 1878

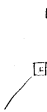


Fig 31

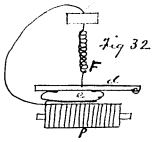


Fig 32

Fig 33

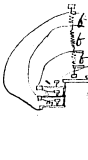
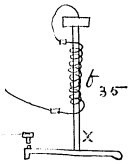


Fig 36



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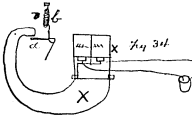
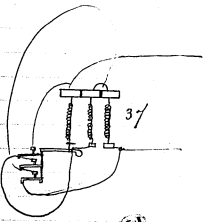


Fig 34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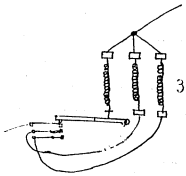
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In figure 22 the arrangement is somewhat different. the expansion of the rod X by the heat of the spiral increases the pressure and decreases the resistance of the button hence cuts off more current from the spiral. thus reducing its temperature,

In figure 23 is shown a spiral F which when it expands throws up the lever. d & breaks contact in the mercury cup. H.
The rod may be arranged to short circuit the spiral F when the lever touches the mercury the spiral being placed in the other side of the fulcrum m.
Fig 24 shews the expansion of the spiral opening its own circuit and the contact point being placed near the fulcrum to gain power.
Fig 25 shows it arranged to short circuit the spiral when the temperature is to high the point X may be fixed as with a spring so that the spiral will not be affected when pressing the lever downward as it would if a rigid point were used.
Fig 26 shews a spiral with a light weight short circuiting itself in a cup of mercury or on a spring.
Fig 27 shews a double spiral F1 & F2 with lever d. connected to the expanding rods m and m' arranged with contact points 1 and 2 so that when f^2 is incandescent m will be expanded and the lever S will leave 2 and pass the current to F which in its turn will become incandescent and pass it back to f^2
In fig 28. this same principle is shewn with short circuiting connections
Fig 29 shews a spiral making a lever having two contact 1 and 2 on its extremity mounted from each other, a spring. 9 is either in contact with one or the other as the spiral is expanded or contracted thus opening or closing the circuit through the spiral or through a resistance

R equal to it but of large wire to prevent heating.
Fig 30 shows a similar arrangement except that as the spirals tends to elongate more and more it is checked by throwing in constantly increasing resistances 1. 2. 3. & 4

Fig 31 shows a spiral which is not heated, but a portion of its spirals touching each other and thus out of action when the passage of the current more and more spirals and consequently resistance is thrown in current by the expansion of the same

Fig 32 shows a method of gradually increasing the power of the shunt or short circuit. P is a cylinder wound with wire offering considerable resistance. It is a spring which when just touching. P comes in contact with but few spirals and as the length of the spiral increases the spring E flattens and comes in contact with more convolutions hence shunting more and more current from F

In figure 33 a coil of wire, gas or steam is to be immersed in the heat, may be used in the water to produce gas by decomposition in the liquid. augmentation in the current increases the gas and cools the spiral F.

Fig 34 shows an electric or other engine with a fan to produce a draft of air to cool the spirals the draft being regulated by the lever D covering the draft tube X.

Fig 35 shows the passage of the current through with the spirals F and a moving lever X thus working it by both direct and radiant heat. the short circuiting device may be used in this arrangement.

Fig 36 shows (3) three spirals in the same circuit with the spirals is an axial magnet - M with a lever O working springs 1. 2 and 3. when no current passes the springs 1. 2. & 3 short circuit the spirals F1 F2 F3 when current is closed the magnet causes the lever 1 to cut in circuit spiral F 3 if the current

strengthens the power of the magnet is increased and causes spring 2 to leave it contact point and cut in spiral F 2 and so on. the resistance of the spirals be sufficient to reduce the strength of the current. one spiral might be used and several resistances connected to the springs 1. 2. & 3

Fig 37 shows a similar principle: the power of the expansion of the spiral being used

Fig 38 is similar in principle.

Fig 39 shows a spiral F placed in a glass tube to prevent oxidation and allowing the spiral to become incandescent with less current than if a number of spirals in the free air E & B are caps for safety of some non conductor of heat.

Fig 40 shows concentric tubes the spaces between being filled with a solution of alum in water to further increase conservation and radiation of heat.

Fig 41 shows a set of relative positions of spirals.

Fig 42 shows a spiral with its regulator inclosed in a glass tube.

Fig 43 shows a spiral wound around a pencil of lime or similar substance to accumulate heat and thus render the spiral incandescent with much less strength of current.

Fig 44 & 45 shows several spirals regulated by a general regulator; for instance if there are 100 spirals in a building they may be arranged with three or four regulators instead of making each spiral do regulate — a straight wire is used as at X - which is not liable to change like the spiral. The regulation takes place at much lower temperature than on the spiral. I will mention that these spirals may derive the current from the main wire by being placed in derived circuits, or placed directly

in the circuit, or the ends of all commutators to one pole and all the other ends to the other pole; I will also mention that any source of electric power such as a battery or magneto machine of the usual construction may be used, but I am now engaged in experimenting on an improved magneto electric machine. I use a large tuning fork each prong being provided with a steam cylinder and valve which serves to keep the prongs in continuous vibration by steam power and forcing the prongs with electro magnets forcing other electro magnets and with suitable contact points obtain powerful induced current by the rapid approach and recession of the magnets

I shall probably claim.

1st Regulating the temperature of commutators heated by the passage of an electric current by their over expansion in the [illegible] by the resistant energy of the metal body substantially as set forth

2d The method of reducing the temperature of a body heated by electricity by causing its expansion to shunt the electricity from it and reduce the amount

3d A magneto Electric machine composed of a tuning fork or reed kept in continuous vibration by steam power as set forth and magnets and their commutators for the purpose set forth;

4th I claim the various devices herein described to carry out my invention in a practical manner for its various uses,

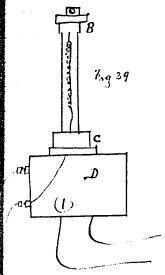


Fig 39

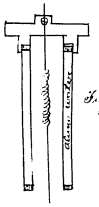


Fig 40

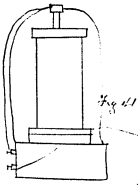


Fig 41

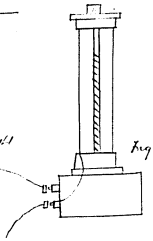


Fig 43

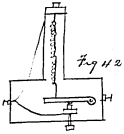


Fig 42

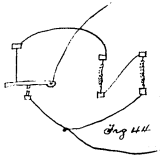


Fig 44

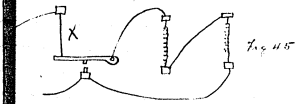
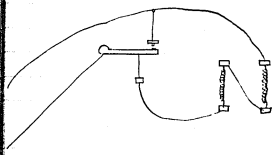


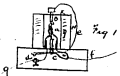
Fig 45

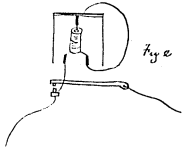
Burner No 2

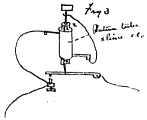
The object of this invention is to subdivide the Electric Light.

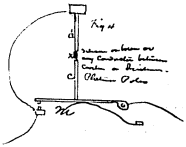
Sept 25. 1878.

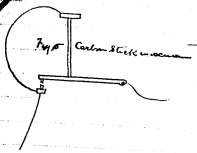


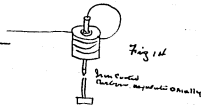




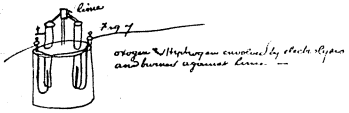


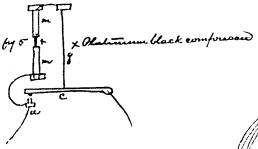


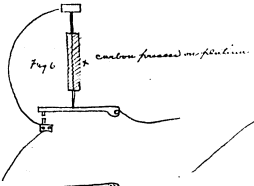


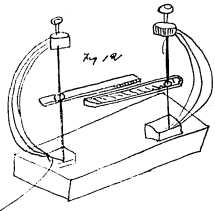


Sept 27. 1878









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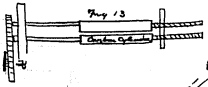
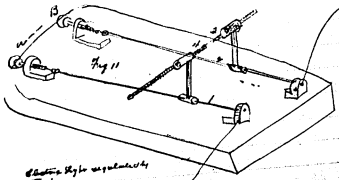
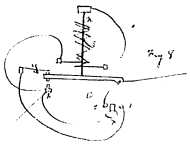


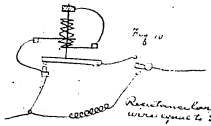


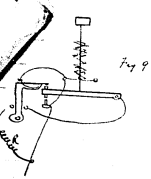
Electric Light separately Coralum

September 27. 1878

Electric Light







The object of this invention is to substitute the Electric Light

The invention consists in various methods of accomplishing this object which I am now experimenting upon

Fig 1 shows a right and left hand platinum spiral a placed in circuit and kept incandescent by the passage of the electric current. this spiral is placed within a glass tube K and this in its turn is placed in another but larger tube H. between this two tubes a non conductor of radiant heat is placed such as a solution of alum. although I hope to be able to dispense with the glass tubes altogether substituting solid alum tubes in their place.

The employment of a casing around the spiral to prevent the radiation of heat reduces the expense of the light as less electricity is required to give heat when the heat is thus accumulated to help keep the spiral incandescent. C is the regulating lever worked by the expansion of the wire B which is of the same size and passes through the spiral a and is included in the same circuit:

when the spiral is raised to incandescence that portion of the rod B which is small becomes incandescent expands and brings the lever C down on the point d and the current is shunted out of the spiral and rod B. they cool and contract the lever lifts from d and they again incandescent.

Fig 2 shows the platina coiled around a cylinder of a material which becomes incandescent from heat such as lime. chalk etc the proper substance to use I am now experimenting to obtain.

Fig 3 shows instead of a spiral of platina a cylinder of Platinum foil or around the lime

Fig 4 shows two platina wires c & c. between which a small piece of silicon, Boron, carbon compressed finely. Platinum Iridium osmium or Ruthenium or other substances which Conducts Electricity and becomes incandescent. The expansion of c c' and the substances used moves the regulating lever m and prevents the temperature rising to the point of destruction

Fig 5 shows a stick of carbon acting by its expansion

to regulate the temperature the carbon being placed with the other apparatus in a convenient tube to prevent vibration
Fig 5 shows a coil of compressed platinum finely divided metal such as Iridium Ruthenium or platinum which becomes incandescent by the passage of the current. placed in the same circuit is a temperature regulating wire q
Fig 6 shows a piece of Platinum wire reduced in size for a short distance from the centre and covered with carbon or other finely divided conducting material
Fig 7 shows Oxygen and Hydrogen produced by electrolysis and collected and burned in some cylinder. several diminished being included in the same circuit
Fig 8 shows the double platinum spirals S with regulating wire passing through it all arranged similar to fig 1 except that a switch x is used to cut the spirals out of circuit when not wanted which it does when the switch lever is in contact with the point R and when in contact with 1 it throws in a safety spring g. which shunts the spirals S around it. fuse and break the circuit allows the lever C to come in contact with it and short circuit the spirals
Fig 9 shows a better form the switch lever throwing the safety spring in position when wanted also has a resistance R which is thrown in circuit when the spirals is thrown out thus preserving an even resistance in the circuit
Fig 10 shows this latter device plainly but without safety appliances
Fig 11 shows an ordinary carbon lamp. B & H are the carbons secured to two arms which are in turn fastened to two screw wires 1 & 2 the amount of travel being regulated by the screws A & B. the carbons are made to connect and the arc produces a Refulgence
Fig 12 shows a modification of this principle
Fig 13 shows two carbon cylinders rotated back and forward by a spindle and screw upon it with reversable gear
Fig 14 shows the carbon sticks are coated with shown and the regulation takes place with an oval magnet.

I claim the various devices herein described
Menlo Park Sept 27. 1878

~~Electric Light Caveat No 3 Sept 27. 1878~~

Above is word W.C

Caveat No. 3.
Electric Light Subdivision.

The object of this invention is to subdivide the Electric Light and to make a Lamp which is self acting or controllable

The invention consists in the various devices for effecting this object. such devices I am now experimenting with to ascertain their availability for the purpose. I have already filed Caveats in which several forms of Lamps are shown and described.
Fig 1 shows the method of causing the rise in the temperature to regulate the temperature of the spirals by the expansion of the inclosed air. Q is the glass case made air tight. U is the incandescent spirals were D is the bottom frame work two air holes B. and B' lead from a chamber containing A into a space. C is a diaphragm air tight. when the spiral A becomes heated it instantly expands the air and this forces the diaphragm outward to a distance proportional to the rise in temperature in the centre of this diaphragm is a platinum wire K facing this is another platinum point I on the end of a flexible spring m when the temperature rises in a certain point come in contact and short circuit

the spiral at temperature falls and the air contracts the diaphragm recedes and the same operation goes on incessantly. It is an extra platina point called the safety "catch" this point is connected to the diaphragm. should the points K & i fail to make a connection owing to incs or to the temperature of a wire rise still higher (but not to its melting point) this wire force the spring m down and the spiral a will be short circuited. Just as if K & i had not failed an extra catch is arranged with the spirals which should at first wire close the circuit. these safety catches are shown in figs 2. 3. 4. 5. 6. 7 & 8 the two springs which hold the spirals in all cases are allowed to fall back or forward when the spirals melts and close the circuit

Fig 9 shows the secondary Battery S.B. arranged with the short circuit to prevent sparks in the points a small condenser might replace it.

Fig 10 shows a spiral filled with some non conductor which becomes incandescent at a low heat

Fig 11 shows a alternate spiral S. immersed in air or a liquid in a seperate compartment covered by a diaphragm the operation is obvious

Fig 12 shows the spirals S in a house worked by secondary Batteries S. B instead of the direct current the latter be used to charge the Battery m and its lever is vibrated rapidly by a self make and break spring or an electric Engine clock-work or other motor may rotate a commutator to accomplish the circuit changes

Fig 13 shows a spiral placed horizontally the two connecting wires being carried through a piece of chalk. C. or similar material m is Brass piece i and i'. to allow the exhausted air to remove the diaphragm K. outward and regulate the temperature of the spiral S.

Figs. 14. 15. 16. 17. 18. 19. 20. 21. 22. 23. 24. 25. 26. 27. 28. 29. 30. 31 & 32. 33. 34. 35. 36. 37. 38 & 39 are different forms in which I propose to experiment with in ascertaining the best form for giving light by incandescence due to the passage of the Electric current through them

Fig 40 shows a regulating wire w and cone c of fine metallic foil left incandescent.

Fig 41 shows a simple method of regulating the temperature of the spiral S.

I shall probably claim regulating the temperature of a conducting body rendered incandescent by the Electric current by causing the expansion of air in which it is inclosed to move a diaphragm lever or equivalent substantially as set forth

2° The double contact points or safety catches substantially as set forth

3° The various arrangement of the incandescent Bodies

Menlo Park Oct 3. 1878

Thomas A Edison

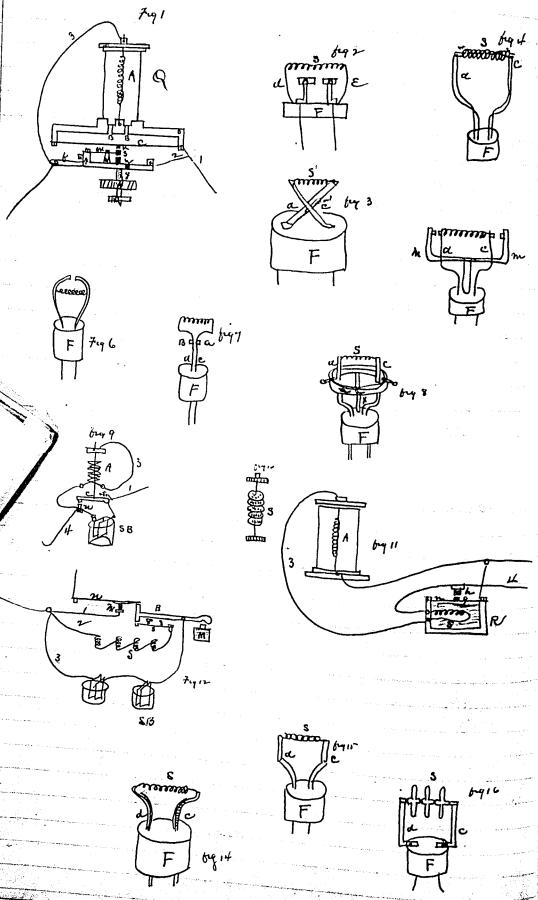


Fig 1
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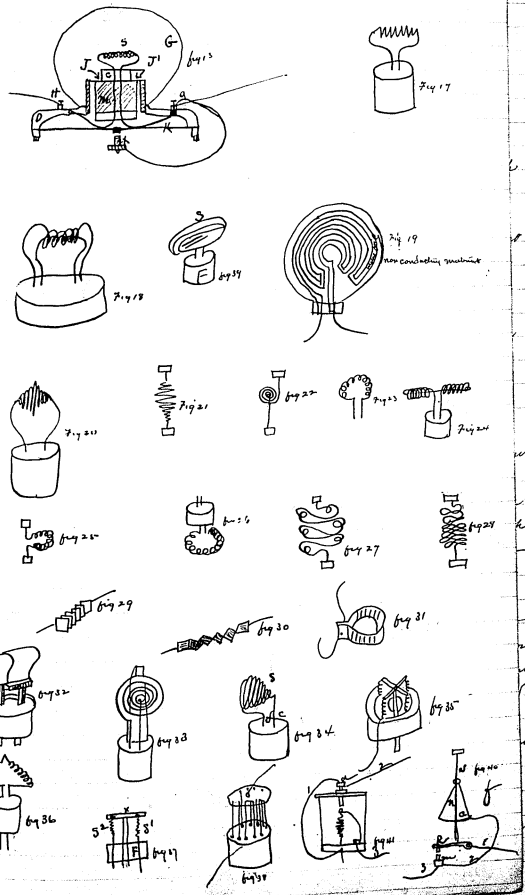
Fig 13
Fig 17
Fig 18
Fig 19
non conducting material
Fig 20
Fig 21
Fig 22
Fig 23
Fig 24
Fig 25
Fig 26
Fig 27
Fig 28
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Fig 30
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Fig 32
Fig 33
Fig 34
Fig 35
Fig 36
Fig 37
Fig 38
Fig 39
Fig 40
Fig 41

Electric Light Subdivision Caveat No 4

The object of this invention is to subdivide the Electric Light by causing the Electric Current to pass through conducting Bodies and render them incandescent

The invention consists in the various devices for accomplishing this object.

Fig 1 shows a piece of metallic foil A. through which the current passes. the top of this foil is secured to the top of the globe holding it at x an overhanging arm d is arranged so that the contact spring B rests upon it and places tension on the foil the extreme end of B is faced with platinum contact is made on a platinum faced wheel g this wheel is secured to a shaft which ~~secures~~ an upward or downward motion without turning by the action of the screw N. M is a rigid stud in which the devices are secured. on the shaft of the platinum wheel g is a ratchet wheel with two springs h & K engaging in its teeth when the screw N is adjusted downward the ratchet and wheel g is rotated about 1/16 of an inch thus bringing clean platinum for contact purposes every time the lamp is used with the wheel 1/8 an inch in diameter a fresh surface would be brought to face that on the spring B once daily for 24 days which is increased as we increase the size of the wheel. C is a small spring attached either to the spring B or to the frames of the instrument the object of this spring is to keep the foil A attached when the spring B comes in contact with the wheel g

Fig 2 shows a resistance R inserted in the circuit when the foil A is thrown out by the expansion acting on the lever L to separate it from the spring C.

Fig 3 shows in place of a resistance R. a second foil

Fig 4 shows a device for lessening the spark when the foil A expands and brings the points together the battery X acts to send a current through A in the opposite direction to the main current In fig 5 C is a chalk cylinder 1 & 2 are springs connected to it. between the springs is the foil A X is a cylinder containing a regulating wire in this wire short circuits itself as well as the foil A when the temperature approaches the melting point In fig 6 the short circuiting lever is worked by tension the expansion of the spring acting to bring the lever around to the short circuiting point

In fig 7 a rod R of silver placed in close proximity to the foil A when it expands to such an extent that it bows out and touches the silver In fig 8 A is the foil d a lever with a pad at c closing the orifice of the tube in through which a draft of air endeavors to pass when the foil expands to a certain degree the pad at c leaves the tube in and a draft of air passing to a malleable coils it by radiation

In fig 9 a double spiral is used to give light and a single wire for regulation

In fig 10 a carbon rod A dips in a molten mass of metal X in the carbon block B this gives brilliant incandescence. a carbon rod A should be fed downwards by proper mechanism as it wastes away

fig 11 shows two carbons 1 & 2 placed within short distance of each other and in contacts at their ends when no current passes. X is a platinum wire enclosed in the circuit and secured to the carbon 2 when the current passes X expands and with the assistance of the spring R separates the carbons and establishes the arc

Fig 12 shows the expansion of a spring X by the heat of the arc

Fig 13 shows double expansion wires A & B

Fig 14 shows two carbons 1 & 2 working on torsion wires the arc being maintained by repulsion

Fig 15 shows a fuse for incandescence on a piece of chalk it is rubbed in the center for strength

Fig 16 — 17 & 18 are similar

Fig 19 A is the foil B a weight short circuit takes place in a cup of mercury X

In fig 20 several levers No 2 & 3 are used to make contact should one fail the others connecting should all fail to connect with H and short circuit the foil it would also be saved by the stirrup S leaving the levers and the current passing through spring 7 and resistance R 6 is the adjusting screw for the contact H. 6 is a mercury cup to insure contact together of all the levers

In fig 21 springs replace the levers of fig 20

In fig 22 the object is the same as in fig 1 but rotation of the platinum wheel is obtained by the expansion of the fine rod X. every time the foil becomes incandescent a click in the rod engages in the ratchet on the platinum wheel

fig 23 shows an ordinary regulator with the addition of a lamp and wick which assists the incandescence of the foil and which for some purposes is a useful adjunct

Fig 24 — 25 & 26 shows methods of connecting the special in a magnetic electric circuit

Fig 27 & 28 shows methods of connecting several regulators in 27 they are connected for intensity in 28 for quantity

Menlo Park N.J. Dec 8. 1878

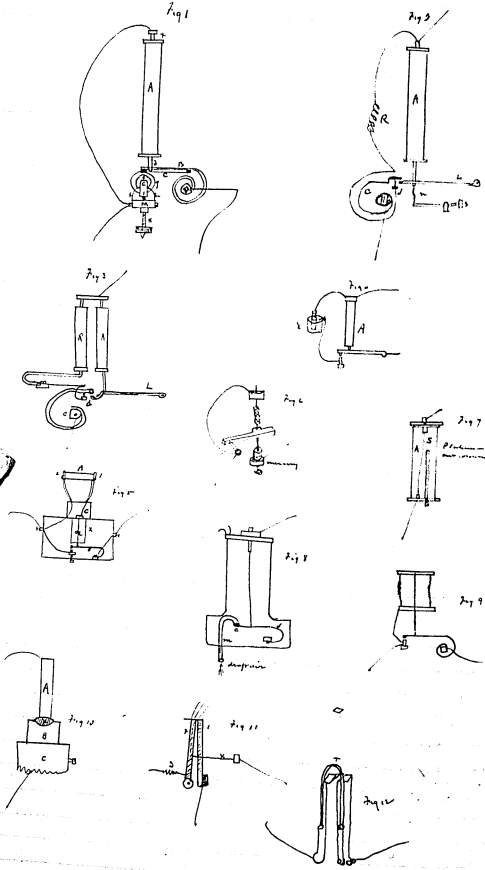
Fig 1
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Fig 12

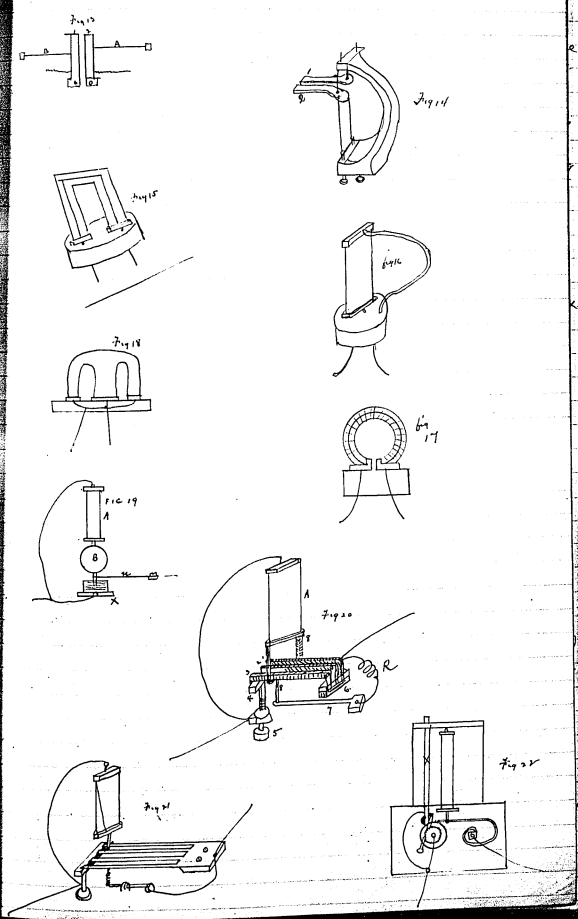
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Fig 14
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Fig 17
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Fig 20
Fig 21
Fig 22

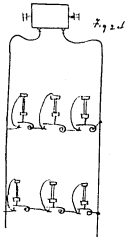


Fig 24

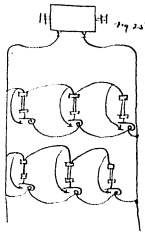


Fig 25

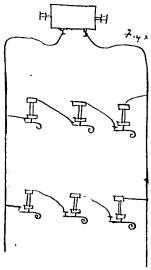


Fig 26

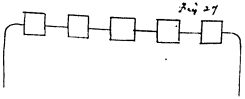


Fig 27

Fig 28

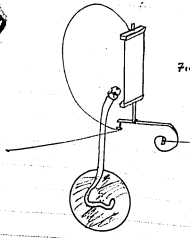


Fig 23

Electric Light Cutout No 1

The object of this invention is to subdivide the Electric Light by causing Cela Cela

Fig 1 shows a method whereby as the current increases in strength the foil A. Expands and rotates the lever B around the disc C by means of the shaft ne and string or cord N. The spring P serves to keep the foil A stretched X ~~F~~ is a flat foil on the face of the chalk disc C. this foil is included in the circuit when A expands the arm B moves to the left and cuts more of the foil X in circuit hence as the current strength increases more foil is thrown in circuit reducing the temperature of A hence A cannot rise in temperature to the melting point

Fig 2 shows a method to decreasing the resistance of the incandescent foil A when its temperature rises hence the temperature cannot rise above a certain degree. Upon the extension of A the lever B is brought in contact with a and a portion of the current passes through B. S. is a spring to keep the foil A stretched

Fig 3 shows the regulation of the temperature of the foil A by ~~stretching~~ short circuiting it. a second but smaller cloth B forming a part of the short circuit

Fig 4 shows the same short circuiting method with the addition of and extra device for throwing the incandescent conductor of our circuit when it is not to be used - throwing in circuit a resistance equal to it. so as to keep the resistance of the line perfectly constant. C & D are contact points operated by the disc X upon the upward movement of the screw g - when they are operated the foil A is cut of circuit & the resistance R thrown in

Fig 5 shows a method of throwing more or less foil in circuit by means of an oval magnet. X is the oval magnet C a pulley, on which a long strip of foil is wound. N is a weight to keep the foil stretched

B is a rod dipping in mercury through which the connection is made, when the current strength increases the core is attracted within the magnet shorts to a certain balance this gives relation to the drum C and the weight w imparts more force

Fig 6 is a similar arrangement w a spring X gives the downward motion. C is the drum carrying the foil and a an extra foil whose expansion allows C to rotate and more foils in circuit

Fig 7 shows a variable short circuit around the incandescent foil A. C is a block on which is wound fine wire a spring w when A expands flattens out and short circuits more or less of the wire on c c thus shortens the shunt around A

Fig 8 shows a similar device X is a spirial spring which acts as a resistance & downward movement of the lever in the expansion of a brings all the shorts together and forms the short circuit thus preventing any spark

Fig 9 is a similar device the rotation of the cylinder short circuits more or less of the springs upon the metal fingers B thus shortening the shunt

Fig 10 shows a shunt formed by a carbon button

Fig 11 is another modification of the carbon button principle

Fig 12 shows a sliding contact point x being the platinum

Fig 13 shows the sliding contact point which in this case does not short circuit the foil A but closes a local circuit containing a battery and magnet the lever of the magnet short circuits the foil A

Fig 14 is a similar device but the magnet is worked by a current from a derived circuit

Fig 15 the magnet does not make a platinum contact short circuit but one by friction thus preventing sparks

Fig 16 shows a rotating wheel with a piece of carbon w it more or less of this carbon is thrown in the shunt as the foil a expands or contracts

Fig 17 shows a device whereby an increase in the current produces increased length of foil a in expanding rotates cl and this having a large cam face (ca) being a larger wheel allow more of the foil B to unfold b is a spring to keep the foil stretched

Fig 18 shows an increased length of foil placed in circuit by means of a fine magnetism

Fig 19 shows a coiled shunt whose resistance is increased or decreased by more or less contact with mercury

Fig 20 shows two revolving contact wheels to move clean contact points

Fig 21 & 22 shows gradually diminishing operation of shunt by means of several springs arranged so that with a slight expansion of the spirial one spring comes in contact with its point and shortens the shunt and so on

Fig 23 a & b show devices for giving increased length of foil when the current strength is increased

Fig 25 shows is similar to 23 & 24 except the movement of the foil is obtained by mercury

Menlo Park Oct 16. 1878

Thomas A Edison

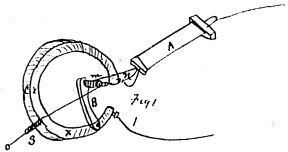


Fig 1

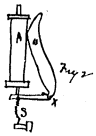


Fig 2

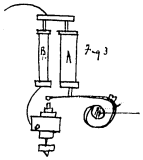


Fig 3

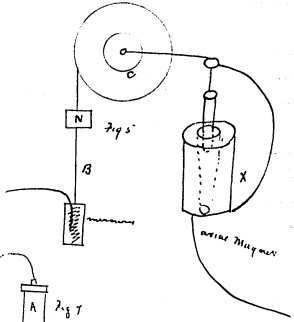


Fig 5

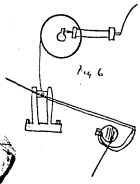
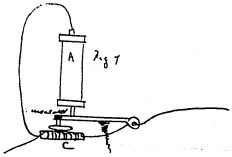


Fig 6



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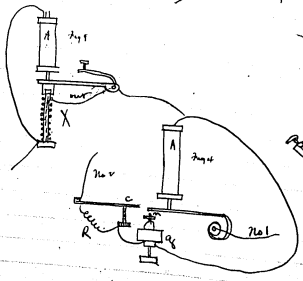


Fig 8

Fig 4

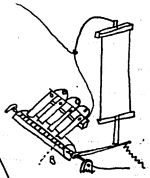


Fig 9

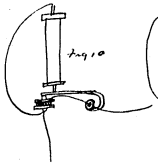
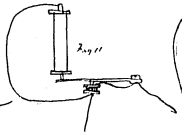


Fig 10



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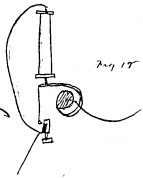

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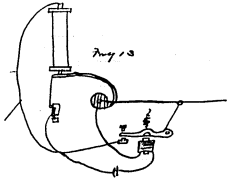


Fig 13

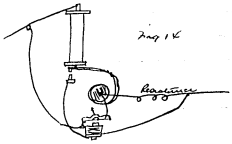


Fig 14

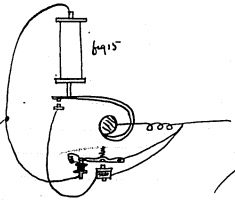


fig 15

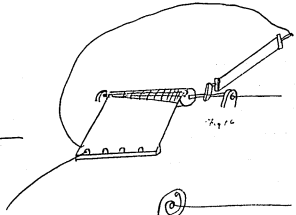
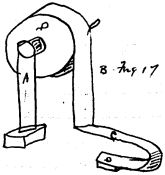


Fig 16



8 Fig 17

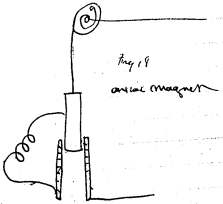


Fig 18
axial magnet

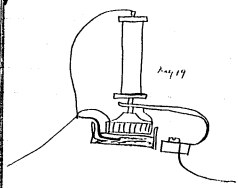
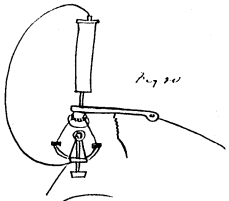


Fig 19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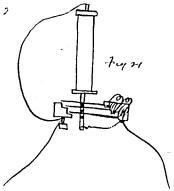


Fig 21

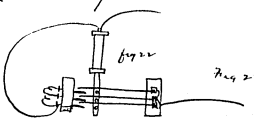


Fig 22

Fig 22

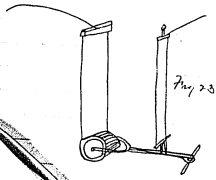


Fig 23

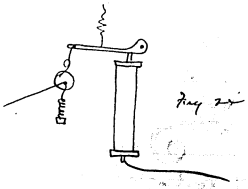


Fig 24

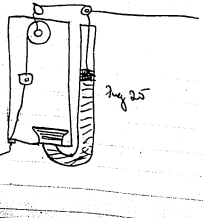


Fig 25

Caveat Electric Light

The object of this invention is to produce Light by concentration of heat rays of long wave length

The invention consists in combination with a reflector as reflector a source of heat whose radiant energy is received upon the reflecting surface either by direct radiation or by conduction and all the rays thus received being concentrated in a focus upon a small point of matter different of fusion. such as Iridium. Zirconi magnesia or lime. bringing the latter to avoid incandescence

In fig 1 – X is a mass of non-conducting material in an air space. R a polished reflector of Copper coated with gold or platinum P. I a platinum Iridium spiral X'X' also a sheet of non-conducting material. Z is a thin piece of Zirconi or Iridium which is the focus of R

Fig 2 shows a a a are a core of pipes containing steam or hot water the heat passes through the reflector R by conduction and the heat rays are concentrated upon Z as before X is a non conducting coating

Fig 3 shows how the reflectors itself may be made of polished tubing
Fig 4 shows a double reflectors with hot water or steam passing between I sometime employ Mg come as a non conductor of heat —
I shall claim
The method herein set forth of producing light by concentrated Heat of low temperature upon and in fusible substance substantially as set forth

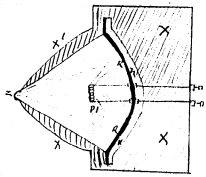


Fig 1

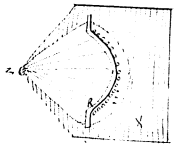


Fig 2

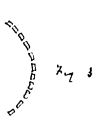


Fig 3

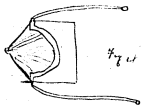


Fig 4

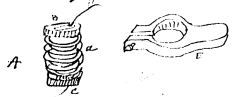
Menlo Park Jan 13. 1879

Carbon Electric Light

The object of this invention is to economically produce light by Electricity —

The invention consists in various methods and devices upon which I am now engaged in investigating with a view of adopting that which proves itself the most practical and economical

When using this incandescence of a moulded material to produce the light. and where the burner is to have a large resistance to admit of practical subdivision I use a coil of the material as in fig 1



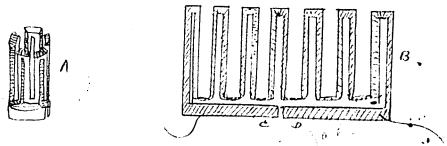
a is a cylinder of the best carbon cut in a lathe like a strong spring with two lugs or ends B.b which are used to secure a perfect connection with the leading wires. = is the clamp for making such connections By this means a resistance of thirty to fifty ohms may be obtained and with scarcely one inch of radiating surface. Of course an moulded conductor may be made in the form of a cylinder and made in this form either by cutting or grinding in a Lathe or by moulding directly —

Metallic silicon. or Boron may be moulded together like carbon. by powdering the silicon or Boron mixtening it with a highly decom-posed compound of these substances — mixing and subjecting them to high temperature just [illegible] silicon is moulded at a temperature [illegible] Various finely divided [illegible] metals may be combined with infusible oxides such as the oxides of Yttrium. Erbium. magnesium. Calcium

Common + analogous Earthy metals can be moulded or worked in this form

In fig 2 is shown another method of forming a burner of high resistances with smaller radiating surface.

Fig 2

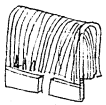


B shows the continuous conductor flat. C + D are the conducting plates of large surface

A shows the flat plates bent round to form the burner

Fig 3 instead of bending B form a round cylinder it may be bent as in fig

fig 3

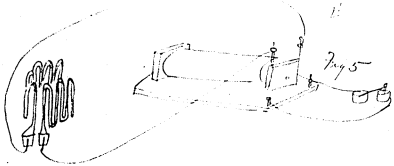


It may be formed in a volute spiral such lines being insulated from the other by an impervious non conductor as in fig 4

Fig 4

In fig 5 is shown a method of producing light by means of vacuum tubes having capillary bores it being known that the luminosity of the light from a vacuum tube through which a jump spark is passing is at the square of the diameter of the bore of the tube =

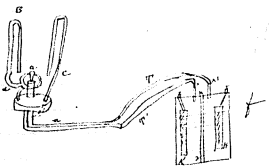
Fig 5 shows a length of tubing arranged like the conductor in fig 2



owing to extreme smallness of the bore and the concentration of a long length of tube in a very small space a very minute coil will give a light of several candle power =

Of course these capillary tubes may be wound in a spiral form

Another method is shown in fig 6



F is a decomposing cell with two electrodes H + K the liquids are seperated from each other by a

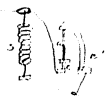
porous diaphragm which serves to allow the passage of the current but does not allow the gases to mix to any troublesome extent. The gas from Electrolysis which consists of Oxygen and Hydrogen are collected through the tubes t t' and conveyed by tubes T T' to the burner = as in bulk of lime. Zircon Magnesia or other infusible substances. d the jet which is formed of a tube within a tube one of which conveys the Oxygen and the other the Hydrogen in double channel. B is used through which either the Oxygen or Hydrogen passes from the cell of before & passes into the jet - d this is for the purpose of utilizing the heat from the jet to warm the gas or gases before passing to the jet =

I propose to construct a large Double cell with Electrodes composed of several bushels of Coke and divided by a porous diaphragm - with two generators the oxygen and Hydrogen are collected for use.

A dynamo electric machine is to be used to effect the Electrolysis = of course any number of lamps may be used according to the power of the machine this system is applicable to Country Houses where a water power or Wind mill power is attainable a concentration of light nearly equal to the Electric Light is obtainable and the economy is nearly as great the only loss being due to the heating in the decomposing cell by the prolongation of the Electrodes and the decomposition of the Ozone into inactive oxygen thus releasing a portion of the energy into the form of unavailable heat. This effect is reduced to the minimum when a single cell is used with a dynamo machine of great quantity - Instead of the jet of flame playing upon the cylinder of Zircon this latter may be fastened as a cup

and placed over the tube from which the jet proceeds as no atmospheric oxygen is required to support combustion as required in a small hole in the ground cup serves to allow the steam to escape =

Fig 7 Shows a new form of Thermal regulator for regulating the passage of the current through an non conducting material.



b is the non conducting conductor -
a is a cylinder or plate of protoxide of Iron or rather magnetic or black oxide of Iron, which is a non conductor when cold but has a conductivity as great as the metal Iron when red hot. this plate is placed between the upright ~~c c~~ and receives the radiant heat from the spiral - It is shunted around it. If the temperature increases to much in the spiral the plate at a certain point becomes a comparatively good conductor and thus shunts the current from the spiral. its heat drops and with it the conductivity of the oxides to be again renewed - The whole may be placed over the spiral to obtain the heat of convection as well as radiation - The breadth and mass of the oxides determines the point when a certain heat will render it suddenly a conductor

Small illuminated points may be obtained by employing Electrodes of Pure lamp black -

Menlo Park Feb 9. 1879

Caveat

Menlo Park N J Mch 17.79

The object of this invention is the perfection of various devices used in my system of Electric lighting.

The invention consists in means for generating electric currents ~~electric~~ ~~lamps~~ machines the power applied to generate such currents also in lamps for utilizing the electricity thus produced, a method of forming electrolytic gases, method of coating wire with a pyroinsulator and lighting by the passage of an induction spark through a line

Fig 1 shows a sealed glass tube x with bulbs at the end within the ends are two metallic discs connected to the terminals of an induction coil c which is supplied with current from a dynamo machine either with alternating currents or direct currents in the latter case the primary wire of the coil is arranged with two bobbins and the current alternately passed through on one or the other in contrary directions or by a self acting ~~contact~~ breaker or the coil is thrown in and out of circuit by the same device. Between the discs n m within the tube x is placed in the narrow part lime obtained from burning acetate of lime which owing to the immense quantity of gas formed when burning puffs the lime out greatly so that a cube 1 inch square will weigh less than $\frac{1}{10}$ of a grain in this state the slightest spark will bring it to vivid incandescence. The tube is exhausted of air.

Fig 2 shows a method wherein an Electro-Dynamo-Machine H is employed to generate a current wires 1 + 2 lead to a decomposing cell containing acidulated water the two electrodes a b are immersed in the liquid and are separated from each other by a porous diaphragm c thus making 2 sealed cells and allowing no gas to pass from one cell to the other > c + d are the binding

posts connected to the electrodes. f. g. are flexible tubes which connect to tubes which pass through the cover of the cells.

Upon the passage of the current decomposition takes place Oxygen is set free at one pole + Hydrogen at the other, these gases being separated are conveyed to the burners by the tubes. N is a double tube the ends one tube within the other the end of the inner tube being even with the end of the larger tube. P is a standard holding a piece of lime X reduced from the acetate. Upon electrolysis the oxygen rushes in one tube of n and Hydrogen through the other and they may be lighted at the end the flame playing upon the lime, a surprising small flame will bring the lime when in this form to a vivid incandescence whereas if allowed to play upon ordinary lime as used in the Oxy-hydrogen flame there would be scarcely any light. In practice instead of the cell shown I propose to use a long deep trough divided in two parts and each compartment separately by a porous partition in each side several bushels of coke is thrown and each batch of coke is connected to the electric conductor the gases due to electrolysis being either burned directly or collected in gasometers. By the use of a single large cell with coke electrodes and evolving the gases separately I am enabled to evolve large quantities of gas with a minimum loss of energy due to polarization which causes heat to be set free and by utilizing the gases so produced by burning them against the form of lime describes the light produced is equal in economy to that produced direct in the arc and may be made of 1 to 200 candle power subdivided indefinitely and stand up for

use. This system is especially applicable to country houses where a windmill-dynamo-machine & cell with gasometer is all that is required one hour's work of the mill storing up enough gas to last a week.

In Fig 3 is shown an improved bobbin of gas-insulated wire. The bobbin is of lime and the wire is of platinum, Iridium alloy gas-insulated. 1 & 2 are thick platinum wires to which the fine wire on the bobbin is connected these wires serve two important purposes 1st to convey the current from the bobbin wire to the base and the other to prevent conduction of heat downwards to be radiated. In my previous applications the lime extended down to the base this became hot by conduction and being a good radiator much heat was lost, whereas the platina wires though better conductors are very small and are very poor radiators another improvement in the bobbin is to make it exactly as thick as it is long as the greatest concentration of heat when it has this proportion. If it is twice as long as it is thick it will make a difference of 2 candle power in 16.

Fig 4 shows a ribbon of platinum-iridium gas-insulated which can be wound around the lime bobbin instead of the wire.

Fig 5 shows a method of coating the wire with an infusible oxide 1 & 2 are lamps whose flame heat the wire, 3 & 4 are stands having sponge on the tops moistened with the lime of magnesia solution resting upon these sponges are levers also having sponges upon their ends the wire passing through the sponge becomes coated with the solution & this is decomposed and the oxide deposited with the gas.

through the flame of the lamp.

Fig 6 shows the wire heated by passing through a hot tube. several hot tubes are used and the wire passes through moistened sponges before passing through each tube.

Fig 7 shows a lamp one bulb within another the inner bulb which is exhausted of air & sealed contains the light giving bobbin X is another sealed bulb coated with the lamp black and having a platinum-iridium wire sealed within it. this wire is in the same circuit as the wire upon the lamp. The end of the tube of this bulb connects to an inward diaphragm which serves to open & close the circuit of the lamp when the temperature rises above a certain point. Of course the wire within X may be dispensed with and the air within X expanded & contracted by the radiant heat from the bobbin an effect which is augmented by the lampblack

Fig 8. shows a wire for winding the bobbins composed of pure iron & platinum or other very refractory metal. the whole of the wire is to pyro insulated and wound in a bobbin this iron wire which is longer is wound within and the platinum wire which is finer covers the outside layer the current passing through both wires brings the platinum to incandescence and the iron wire to a yellow heat, which heat is not lost but must be radiated; conducted through and radiated by the platina. The object of this is to make the lamp of high resistance without loss of energy or light and use

a cheaper metal.

Fig 9 shows a new form of dynamo electric machine in which great concentration of field and cutting wire is obtained and at the same time the rapidity with which the cutting wire is passed through the field may be increased to almost any extent without increasing the rotating speed of the shaft. a is a ring composed of iron wire around this ring is coiled insulated wire in sections there being several hundred sections the wires between the sections are connected as in the Gramme machine to the Commutator. P is the field magnet which may be supplied with Energy from the ring a or from an external source. It is provided with the pieces p p q q p q which are shown in section in the actual machine these pieces entirely cover the ring except a small slit where the spokes of the ring pass to it. c is a commutator which in all positions of the ring connect to the bobbin between the field magnets. d. e are also springs both connected together and are connected through the commutator which with the bobbins on either side of the field magnets only that portion of the wire on the ring near the field magnet is used or adds resistance to the circuit the resistance of the wire length of magnet + concentration of the field is independent of the diameter of the ring which may be several feet. this is not the case with the Gramme ring as if we desire to increase the speed with which the wire passes through the field we must make the ring larger but this will increase the resistance and as the whole of the

wire should be covered by the field magnet it must be spread out thus weakening it hence the increase of resistance and weakening of the field prevent obtaining high speeds except by quicker rotation of the shaft which increases the friction.

When the wire on my machine which is passing through the field a circuit passes from the coil on each side of the wire from C down through it in the same direction and passes inwards through the two other wires leading from e + d.

Fig 10 shows this arrangement with field magnet in circuit with the ring wire.

Fig 11 shows a double field magnet with ring passing through the pieces at its centre the two north poles of the magnets are connected to one piece and the two south poles to the other.

Fig 12 shows the principle arranged with reciprocating mechanism a is a shaft b an eccentric x a magnet covered with wire which is reciprocated by the eccentric n n s.s. the field magnet s.s are south poles n n north poles a wire g is secured to the centre of the wire on x the two other extremities of x are connected together and from the other pole alternating currents are set up and these may by the use of a commutator be turned into continuous currents

Fig 13 shows the principle applied to a telephone d the diaphragm x the iron shell and wire reciprocated in the magnetic field by the movement of the diaphragm s. s are the south poles of the magnet and n n the north poles. the wires are connected as in fig 11 of course permanent magnets may replace

n.n. s.s.

I have shown a local battery L B to permanently polarize the magnets but these magnets may be placed in the main circuit with X and battery put on the line.

Fig 15 shows how the extra field magnet of a Gramme machine may be dispensed with and the ring itself be made a field magnet and cutting magnet at the same time.

Suppose X was a thermo battery or other source of electric energy the current would pass to the ring by the commutator springs 1 + 2 making the top & bottom of the iron ring n + s respectively & be a mass of iron only. 3 + 4 are the usual commutators if these be closed and the ring rotates the current set up tends to make a n pole on the right and a s pole on the left hence the polarity of the ring is at 90° to the iron pieces hence attraction which tends to retard the rotation and this sets up currents.

Fig 16 shows an arrangement by which continuous and alternating currents may be obtained from an ordinary Gramme ~~the commutators are either closed or arranged~~ with the wire on the field magnet so that the current set up in the machine will energize the field magnet at a point at right angles to the commutator springs both on the top & bottom of the ring the continuity is broken and the two ends of the wires are taken to discs upon the shaft upon which springs rub these springs have wire connected to them and if these wires be closed continuous currents will be taken off by 1 + 2 and energize the field magnet while alternating currents will pass through the circuits. e.g. 7 + 8 are to circuits connected to Carbon points to form an arc lamp.

Fig 16 shows only the top of the ring cut and its two ends connected to discs or rings upon which the springs n + m rest.

Fig 17. Shows a dynamometer for measuring the amount of horse power absorbed by the dynamo machines while supplying current. M is several cone pulleys connected to a shaft a. These pulleys are connected directly by belts to the main shaft. 1. 2 + 3 are insulated discs with springs resting upon them

g is a disc connected permanently to the shaft a

H is an electro magnet also connected also connected permanently to the disc g. It has an armature from the end of an arm which is secured to a loose pulley X also upon the shaft a from the pulley X a belt leads to the dynamo machine the springs 1 + 2 connect with a battery B resistance coils C and galvanometer D. 2 + 3 connect with the magnet H 1 + 2 connect with the disc g and back point K forming a circuit when the arm from X rests against K in which circuit a bell and battery is placed.

When it is desired to test the amount of power absorbed by the dynamo machine the battery B is put in circuit and H attracts the arm of X and locks it to g rotation takes place. The operator now watches the galvanometer and commences to insert resistance until the power of the magnet is so weakened that the armature on the arm of X flies from it striking K this closes the bell circuit and just as the bell strikes the operator notices the deflection of the galvanometer which gives the strength of the circuit and having previously determined the amount of weight which would pull the arm away with different strengths of currents is enabled by taking the speed of rotation to accurately determine the power absorbed in foot pounds.

Fig 18 shows a quantity dynamo electric machine. S is a shaft m a magnet with wires the two ends of the wires are connected to discs 1 & 2 c c are shells of copper which envelope the magnet m at the center the shells connect electrically with the iron of the core of the magnet m on the end of the shell are pulleys of metal flexible wire rope serve to give rotation to these shells and also convey the current these shells rotate in opposite directions. The currents thrown in them pass through the iron of m and the shaft becomes one end of the circuit while the pulleys & wire ropes are the other ends One shell supplies current to the field magnet m

I will mention that for regulating the strength of the currents in a Gramme machine that the two Commutator springs or brushes may be connected to a rotating disc and if placed at right angles to their proper position no current is produced or power absorbed by the machine but if turned the slightest toward the proper position to obtain a maximum current then a current is set up in proportion to this movement hence by turning the commutators we can obtain any strength of current we desire without stopping the machine or causing any greater absorption of power than is necessary to generate the current

Claim. 1st producing light by an induction spark passing through lime as prepared in a vacuum

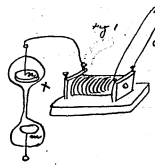
2d The use of lime thus prepared in the Oxyhydrogen light

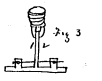
3d Producing Oxygen & Hydrogen substantially as described (ic) with Coke-porous diaphragm

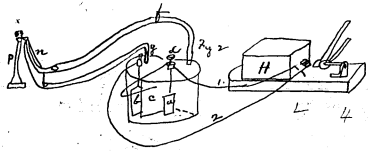
4th A dynamometer substantially as set forth.

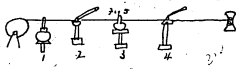
5th The method of obtaining continuous and alternating currents from a Gramme machine

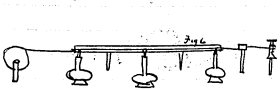
6th The Dynamo Electric Machine shown in figs 9 10 & 11 etc

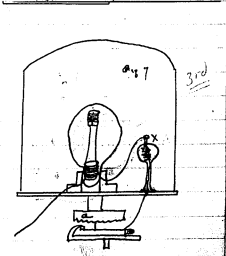












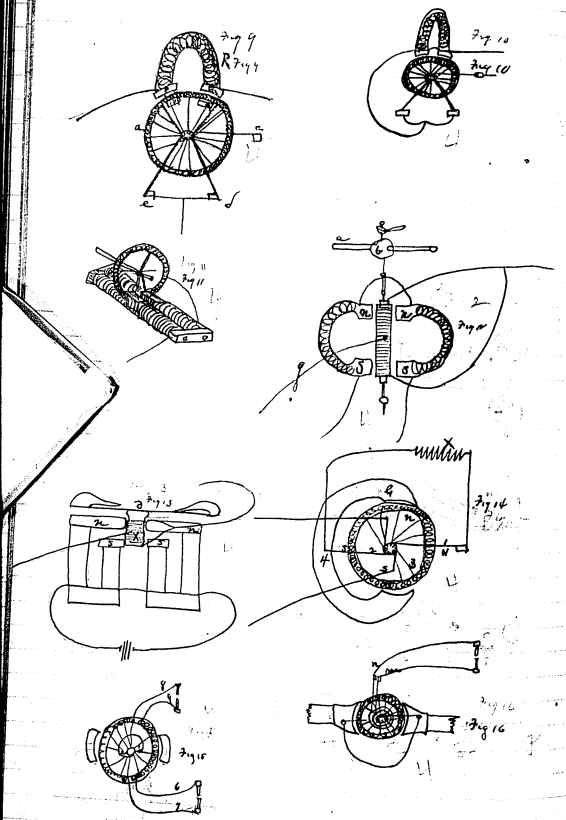


Fig 9
R Fig 9
Fig 10
Fig 10
Fig 11
Fig 12
Fig 13
Fig 14
Fig 15
Fig 16

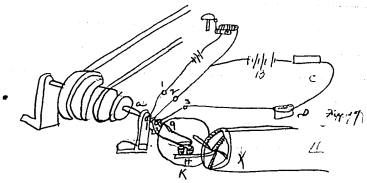


Fig 17
K

Caveat

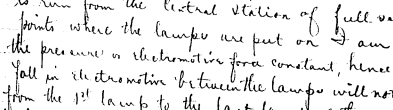
The object of this invention is to economically sub-divide the Electric light.

The invention consists in various devices to produce an even or equal electromotive force in the circuit, to moderate the power of the light without the interposition of devices wasteful of the electric energy.

Various devices to automatically regulate the electromotive force.

The method of arranging the conductors in peculiar proportions that a street one quarter of a mile is to be lighted and 1000 electric lamps are to be used all arranged in multiple arc. I first run two conductors 1/4 of the distance from the central station of a certain size and electrical resistance to this point. If put no lamps across the two wires, the remaining distance I enlarge the conductors commencing very large & tapering down to the size from the station or below that size, on these conductors of increased size I place say 250 lamps, again from the central station I run two other conductors to 1/2 the distance or 1/4 of a mile & there connect enlarged conductors until a point is reached where the large conductors commence on the first circuit, on this conductor I put 250 more lamps, then another circuit 3/4 of a mile is run from the central station of full size, thus up to the points where the lamps are put on I am enabled to keep the pressure or electromotive force constant, hence the difference of fall in electromotive between the lamps will not take place gradually from the 1st lamp to the last lamp of the 1000 lamps as it would if they were all on one circuit but will only fall between 250 lamps in 2 cases and 500 lamps in one case but if the circuit containing 500 lamps is split up into two circuits then the fall will be very between the extreme of 250 lamps

Fig 1 represents 3 circuits



1 & 2 represent the lamp wires of the longest circuit N is the central station C.C. are the smaller leading wires connecting at B B' with the enlarged tapering conductors, x x x are lamps 3 & 4 the 3d circuit & 5 & 6 the shortest circuit. The electromotive force will be the same at B B'. K K' M M' hence the difference in the amount of light given off by the lamp nearest the station and the one farthest from the station will only be 1% per cent under the most favorable condition. The drop in the electromotive force between the circuits with no lamps upon them and when they are all on is independent of the unavoidable drop between the lamps & may be controlled by hand or by automatic devices. When controlled by hand a small wire should be connected to the end of every circuit and returned to the central station and there connected permanently with an electrometer by which any drop in the electromotive force can be seen at once and the rise in the electromotive force may be obtained either by increasing the speed of the engine or of the Dynamo machine or "Exciter" which serves to supply a permanent current to the field magnets of the inductor bobbins of the machine of the main conductors. The rise may also be to a certain extent be effected automatically. Thus; the field magnets being supplied with current from an Exciter and the induction bobbin connected to the line in multiple arc, the latter has one end disconnected therefrom and the field magnet wound with a separate coil, over the regular coil, and the bobbin wire connected to one end the other end being connected to the main conductor.

This extra coil has but a fraction of the resistance of the induction bobbin thus without this bobbin the current from the exciter would acting in the field magnet coils give sufficient magnetism to cause the induction bobbin to show an electromotive force of 95 volts which is raised to 100 when the extra coil is in circuit. If now lamps are placed on circuit they tend to cause a drop in the electromotive force of the induction bobbin but the amount

of current taken from the machine being increased this reacts on the extra coil to create a stronger field magnet and the drop is prevented, this device is efficacious when the field magnets do not approach any where near their point of saturation.

Another method consists in winding an extra coil on the field magnet of the exciter itself of very low resistance and interpolate it in one of the main conductors so that all the current which comes from the combined bobbin shall pass through this extra coil.

Another plan consists in connecting all the extra coils of all the main machines in Multiple arc and interpolating the combined conductor in the main circuit so that the whole current shall pass through the extra coils.

The method to increasing and decreasing the amount of light from the lamp is as follows and is shown in fig 2.

a is the burner b c the platina wire supports X is an Electric Engine having a resistance 200 times less than the lamp when the latter is giving maximum light; K is the rotating armature which is kept in rotation by having the magnet short circuited by break n spring m & shaft revolving time the armature approaches the poles. The short circuit wires are 22 + p (dotted line to represent the back) Q is a break wheel on the revolving shaft at the bottom of this wheel there is but little metal the most part of its circumference being insulating material the amount of metal on the periphery gradually grows greater until near its top when the whole circumference is metal on this rests permanently a contact spring

or roller h connected to the lamp by wire 24 on the lower part rests a spring f which by means of an adjustant can be slid up or down Q by the screw g the current entering at 23 passes through the lamp thence to h through the metal of Q and if the engine is revolving passes to f each time the metallic portion of Q comes in contact with f thence by 20 through the magnet & to 23 while the Engine is revolving the amount of metal on Q being 8 times less than the insulating substance the lamp only receives 1/8 of the energy which it would receive when the surface of Q wholly metal and this amount of energy is wholly independent of the speed which Q revolves this will cause the lamp to be brought only to say a dull red. If now the spring f be raised the amount of total contact will be increased and more energy will pass to the lamp and by this means the spring f may be raised until it is at a point where the surface of Q is wholly of metal. In practice I arrange Q so that f when down to its lowest limit it rests wholly in insulation, an extra appliance or lever is arranged with the screw g whereby an initial motion or start is given the shaft of the engine when the lamp is to be turned on.

It is obvious that any form of magnetic motor may be used to give a constant rotation to Q even a clock work would serve to give sufficient motion it being wound up in the act of turning on the lamp, or a hot air motor ~~obtaining~~ using its heat from the lamp might be used a vibrating fork, lever, reed may be used.

Claims.

1st The system of electric conduction substantially as herein described

2d The methods herein described for regulating

the electromotive force in an electric lighting system.

3d – In combination with an electric current of a moving break wheel or analogous device of variable conducting surface so that the circuit may be closed for a greater or less period at each revolution or movement by moving a contact spring over its periphery for regulating the total energy passing in a circuit

4th The electric engine X in combination with the revolving break wheel C for the purpose set forth.

Menlo Park N.J. July 20. 1879

To All whom it may concern

Be it known that I Thomas A. Edison of Menlo Park in the State of New Jersey have invented an improvement in the Telephone of which the following is a specification as far as perfected.

The object of this invention is to transmit sounds to a distance over electric circuits and thereby as telephones.

The improvement consists in various mechanical modifications in my carbon telephone.

In my application No. 158 filed Nov. 11th, 1878 I have shown the increase and decrease of pressure on the carbon button by the momentum or inertia of a mass held against and moving with the diaphragm.

The following are modifications of the same

Fig. 1 shows a carbon button E secured to the diaphragm N. A is a weight with a platanized screw o passing through it and resting upon the carbon button. B.B' are springs which serve to hold the weight A in position. The amount of initial pressure may be regulated by the screw o. L & M are the circuit wires connected to the primary coil of an induction coil with battery in circuit. Owing to the inertia of the weight and not being able to follow every rapid movement of the diaphragm there results a difference of pressure between the screw o and the carbon. The screw may be also tipped with carbon in fact instead this wafer of carbon may be used or a disk or piece of any shape may be used. The weight A may be round square hexagonal oblong oval or in any configuration so long as it is a weight. It may be a hollow sphere cube or other shape and be filled with mercury or any other heavy substance.

The springs B.B' may be broad or narrow and may be bent in any shape between the weight A and disk upon the diaphragm

In Fig. 2. A and B are pieces of carbon or other finely divided

conducting matter secured to the diaphragm N. each carbon is connected to the circuit; when in a state of rest the two ends are in a state of rest the two ends are in contact with each other.

The amount of initial pressure being regulated by the boring inwardly the diaphragm by the spring C and screw D.

Fig. 3. shows two flat carbons A, B. secured to the diaphragm N and adjusted so that the ends are in contact, the boring outwardly and inwardly of the diaphragm from the normal position tends to increase or decrease the initial pressure.

Fig. 4 - shows an inertia transmitter, E is the diaphragm a. is rubber, or other diaphragm. B a spring serving to force the weight C in position D is an adjusting screw whereby rest on the carbon discs X - The operation is the same as fig. 1.

Fig. 5. shows a double inertia transmitter the two carbons X X being connected together hence the difference of pressure takes place at two points.

I will mention that the carbons of either figs 1. 4. or 5. may be fastened to the cups permanently or they may be loose: the latter is preferable.

Fig. 6. shows an inertia telephone E is the diaphragm N. the carbon button. C the rubber standard A the weight which is of iron and is secured to the spring B which may be made adjustable. M.B. is a permanent magnet which may be made to approach or recede from the weight A and thus increase or decrease the initial pressure on the carbon.

Fig. 7. shows one of these transmitters secured to a diaphragm E which in its turn is pressed to a larger rubber diaphragm F.

Fig. 8.

shows another form of inertia transmitter. C is the

Fig. 9.

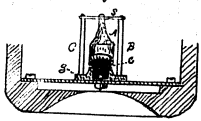


Fig. 11.

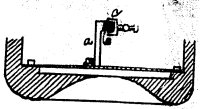


Fig. 10.

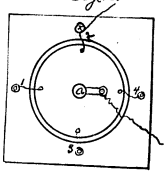


Fig. 12.

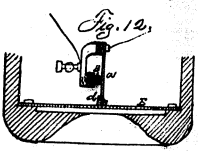


Fig. 13.

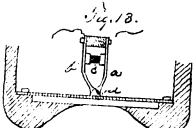


Fig. 14

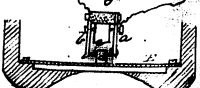


Fig. 15.

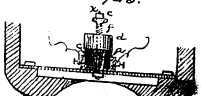


Fig. 16

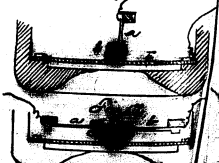


Fig. 18

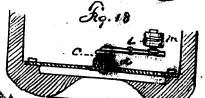
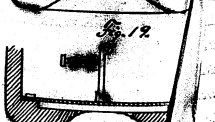


Fig. 17



carbon. It is moving both in a tube with an opening at [illegible] and the whole secured to the diaphragm E.

Fig. 9. Shows another form C and B are uprights secured to the rubber piece g. which is secured to the diaphragm, S is the carbon which rests on the platinized surface of a screw which serves also to connect g with the diaphragm A is a weight. S is a spring which serves to give to A an initial pressure and holds it in position a screw may be connected from the spring S. to the point of A and thus made adjustable. The operation is the same as in Fig. 1.

Fig. 10. Shows a diaphragm with the inertia transmitting device upon it and secured to the wooden case x by springs or elastics. 1.2.3.4.

Fig. 11. Shows an upright a. the upper end of which is platinized and rests upon the carbon disc B which is in the adjustable cup c. The movement of the diaphragm increases and decreases the pressure upon the carbon.

Fig. 12. Shows another transmitter. E is the diaphragm a is a spring lever which is given a side motion by the movement of the diaphragm; by means of a lead piece d. B is the carbon button against which the spring a rests and closes the circuit. the pressure is regulated by the movement of the diaphragm.

Fig. 13. has double lever a. b. c is the carbon d serves to separate both levers simultaneously and they carry their carbon button with them.

Fig. 14. Shows a block d connected to the diaphragm E. in this block is a hard carbon rod c. against which the springs a. b rest. they are bolted; any outward movement of the diaphragm tends to increase the pressure

Fig. 15 is an inertia telephone with two carbons a. c. connected together: resting on these carbons is the weight d which is kept upon them by the spring f. around the insulating rod x. e is a nut for increasing or decreasing the tension of the spring.-

Fig. 16. is the same as fig 14 except a wheel b of carbon is used.

In Fig. 17. the diaphragm E has a block d to which is secured a carbon c. resting on this are two springs a and b the forward movement of the diaphragm increases the pressure at both points of contact.

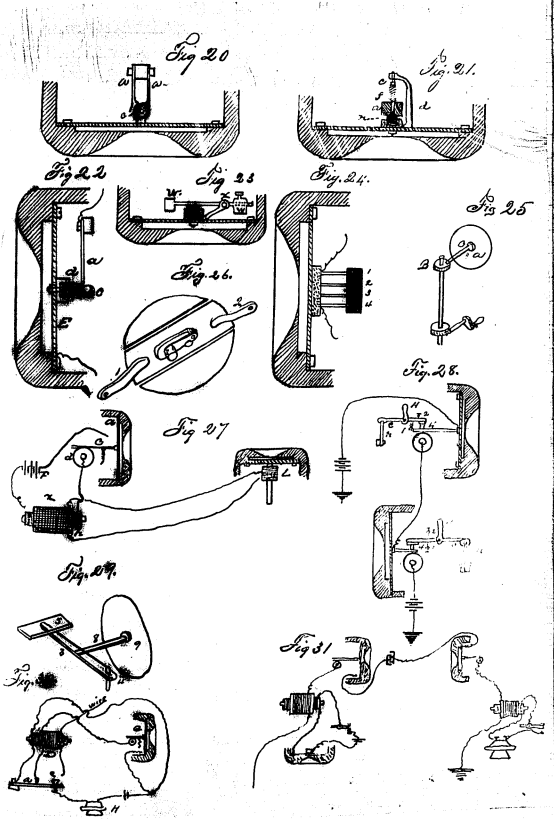
Fig. 18. shows a cup d. with carbon rod c. in it resting upon the carbons is the lever L the initial pressure may be varied by the electro magnet M. which may be the primary coil of the inductorium or disconnected therefrom, or it may be a permanent magnet or even a special or flat spring may be used or if the diaphragm is held in the right position its own weight may be used.
The device shown in fig. 19. is similar to that in Fig. 14.

Fig. 20. shows a wheel of carbon c and double springs a. a. used and operated in the same manner as in fig. 16.

In Fig. 21. d is an upright in the base of which is the carbon M. on this rests a weight a. a hole being drilled through it into which passes the rod around which the adjusting spring f. is coiled; this serves to hold the weight in position by the nut c the initial pressure may be regulated.

In Fig. 22 E is the diaphragm. d the carbon a a semicircular spring with carbon tips upon its extremity resting against the carbon connected to the diaphragm. C is a weight.

Fig. 23. shows an inertia transmitter. W. W' are weights secured to a lever pivoted at x form an arm which



connects with a diaphragm. The center of this lies upon a carbon button in the cup upon the diaphragm. W is adjustable so as to adjust the initial pressure.

Fig. 24. Shows a receiver based upon the two springs some of are insulating blocks upon the diaphragm the current enters via spring 1 thence through the carbon lips to the carbon lips C & S and out by the spring 2.

Fig. 25. Shows a receiver based upon the electromagnetic principle. A is the diaphragm B a disc of steel or other such substance attracted with strength of some other proper chemical to produce the mechanical action the spring C connecting the diaphragm with the disk. B is lifted with vulcanite. The shaft of the disc is secured by a screw and worm wheel E.

Fig. 26. Shows an India telephone secured to a strip of steel material called a diaphragm. It is held against its case by springs 1 and 2 which are tipped with rubber or other soft substance.

Fig 27. Shows the microphonic receiver arranged as a transmitter. A is a diaphragm C the spring connecting the same with the shaft d. The shaft d is not rotated this apparatus is inclosed in a primary circuit of an induction coil x. E is the coil which has a high resistance F is a battery L is a magnet receiver or it may be an exact copy of A. The action is as follows:
When the diaphragm A is shaded by the voice it sets in motion the spring C this instantly deposites the point of contact between it and the shaft d thus increasing the flow of current from F the resistant C comes to rest it polarizes and weakens the current from F

Fig. 28. Shows the microphonic arranged to transmit direct from one to the other without the intervention of an induction coil also arranged so that the sound by raising a lever C.D. is made receive or transmitter. A is the rubber pressure which presses the spring from the diaphragm down upon the shaft when receiving. C is the lever with handle D. 1 and 2 are insulating strips. B is a spring with roller which serves to hold the lever when it is drawn up or down both instruments are alike. When receiving the pressure is put on the spring resting upon the shaft and it is rotated but when transmitting, the pressure on the spring is light and the shaft is not rotated.

Fig. 29. Shows a telephone in which each sound wave is made of an aggregation of smaller waves. S is a lever pivoted at P near the fulcrum H. is arm arm 8 connecting it with the diaphragm A. 5 is a block of firmly seasoned sounding wood the end of S rests lightly upon it the block 5 is connected to one part of the circuit while S is connected to the other part, the vibration of the diaphragm causes to respond the spring 8 and the motion of 5

Fig 30. Shows a push button arranged to show the receiver circuit when transmitting and vice versa upon the transmitting circuit when receiving thus preventing the battery or primary coil of the induction from short circuiting each other circuits. X is the push up to lever which up the battery coil D. is connected through the primary with the receiver C when down the carbon transmitter A is connected in circuit and the battery circuit broken at B.

In Fig. 31. the two chemical receivers are in the main line with a condenser, the latter to prevent the circulation of earth currents through the shaft and thus neutralize them. The battery coils are thus disposed with.
I not mention that steels, buttons, a disks of finely seasoned sounding matter may be made of the following named materials. Carbon, Lampblack, Anthra-

Sic Coal, Bituminous Coal, Anthracite Coal, Gilsonite, Petroleum Carbon, Lamp Carbon, Gas Carbon, Carbon from Burning Organic Matter, Phosphorus Carbon, Shaped Diamond, Crystalline non-organic Matter, Graphite (Plumbago), Black Lead, Carbonate of Iron and the Carbonate of the Metals, Metalized Carbon, Metalized Graphite, Metalized Black Lead, Metalized Lamp Black, Peroxide Lead, Peroxide Manganese, Oxide Copper, Sulphide Tin, Sulphide Iron, Sulphide Copper, Sulphide Antimony, Sulphide Nickel, Sulphide Salt, Sulphide Copper, Sulphide Bismuth, Sulphide Lead, Selenide Cuprite, Sulphide Sulphide Chromium, Sulphide Mercury and all the conducting Sulphides, Nitrate Potassium, Nitrates, Nitrites, Platinum, Palladium, Iridium, Zinc, Copper, Lead, Tin, Iron, Chromium, Titanium, Aluminium, Selenium, Tellurium, Carbon, Bismuth, Boron, Cobalt, Calcium, Barium, Calcite, Columbium, Didymium, Erbium, Glucinium, Cerium, Lithium, Magnesium, Manganese, Mercury, Molybdenum, Nickel, Niobium, Osmium, Palladium, Amorphous Phosphorus, Iridium, Rhodium, Silver, Sodium, Strontium, Tellurium, Thorium, Tungsten, Uranium, Vanadium, Yttrium, Zinc, Zirconium, Magnesia, Oxide of Iron, Dampier, Calcium.

Any known substance which conducts electricity and which can be powdered may be mixed by itself or mixed with one or more other conducting or non-conducting substances to form the tension regulator for a telephone.

For making the case of the telephone any known wood metal or manufactured or native substances may be used.

I shall probably claim all the devices substantially as herein set forth.

Signed by me this 7th day of Aug. A.D. 1879

(Signd) Thos A Edison

Witness
S. L. Griffin
Chas Batchelor

The object of this invention is to produce carbon conductors of high resistance to produce the electric light by incandescence.

One of the materials I employ is made by taking commercial lamp black and subjecting it to high heat in a close crucible afterwards the lampblack is mixed with tar until it is quite sticky, it having now will mixed more lampblack is added from time to time until it becomes of a consistency that it can no longer be worked in by a spatula or in a mortar. It is then pressed in by rating and twisting until it has just sufficient plasticity to allow of being pressed out in a flat plate to do this a small piece is rolled by the fingers until it is in the form of a cylinder or rod. It is afterwards rolled out to the proper length and thickness by placing it on a true flat piece of wood and rolling it back and forward when it has reached the proper shape it is dusted over with a powder which is non-combustible, this prevents it sticking to any substance in which it may come in contact - a mandrel has upon it a copper spiral composed of silver wound or made with it and afterwards like a washer the plastic carbon rod is wound between the turns of the copper spiral and the latter is pressed together thus flattening the sides of the plastic carbon and giving it the same shape as the copper spiral. The ends of the plastic carbon is then bound to platina wires by placing two ends of the plastic material at the point where the platina wire is inserted in the plastic carbon the wire and copper spiral is then clamped in a proper frame work the mandrel is withdrawn and the former placed in a recess in tube and subjected for a few minutes to a gradual increase to a white heat the volatile part of the tar being drawn off and the remainder carbonized locking the lampblack particles firmly together and making a stiff spiral. While being carbonized the plastic material shrinks considerably and this is the main difficulty of the operation of the manufacture and I am now engaged in perfecting the mode of making so as to produce these spirals cheaply, after carbonization the copper spiral is eaten away by nitric acid leaving only the carbon with the platina wires. The latter are by

the act of carbonization some firmly attached to the carbon so much so that it is with difficulty that they can be detached and the resistance of contact between the carbon and metal is much lower than it would be if the carbon was pressed against the platina by a clamp with sufficient power to weld the parts. One reason why platina wire for the carbon makes a superior contact is that combustion during carbonization produces a powerful pressure between the carbon and platina and another reason is that at the white heat of carbonization platina is attacked and combines with the carbon. Due to the discovery I am enabled to obtain a good contact between the carbon and leading wire without the necessity of clamps which are so rapid a resistance would be difficult if not impracticable, with the ordinary methods of manufacturing carbon the difficulty is not so great, as the carbons are made very homogenious by the use of hard carbon particles and the several dippings and carbonizations which they undergo to make them more solid and of low resistance. A spiral of carbon formed of lamp black is far more homogenious under the microscope than a carbon one made in the ordinary way but which has at least 10 times the weight of the former. My great object is the production of a carbon with of the highest possible resistance that will have as low resistance as I have discovered that no matter how rare the carbon is if placed in a vacuum wherein to the millionth of an atmosphere; that this space is sufficiently void of oxygen to cause the conductor to be absolutely stable by means of boiling the plastic carbon in the form of a spiral I am enabled to use a greater length of carbon and of greater mass without unnecessarily increasing the radiating surface thus I can use a more homogenious carbon and have a higher specific heat given the lamps thus lengthening the cooling time of the same and make it less responsive to changes in the strength of the current by this means I obtain a lamp of sufficient high resistance to allow of the subdivision of the electric light practically by placing the lamps in multiple arc. The resistance of the plastic carbon may be increased by mixing with it

while plastic powder which are insoluble such as graphite powder, or powders which are of such highly attenuated minute such as starch, fine sand may be used as this becomes insoluble at a high temperature magnesia graphite which is low compact may also be used, even slate carbon may be used which should be finely ground and mixed with some non conducting substance to separate the particles. Whatever it may be of such low resistance as to require a great length to obtain the requisite resistance and a consequent increase in the radiating surface and time of energy a hollow of fibrous carbon may be formed by winding within the copper spiral one layer and covering the whole with paper over which another copper spiral is placed into which a second layer is wound the copper spirals might be dispensed with and the plastic carbon rod sealed with shellac or starch is formed in one or more layers one over the other upon a mandril which is afterwards withdrawn, the whole subjected to carbonization after which the carbon rods is sufficiently stiff to hold in position each rod being separated from the other by the shrinkage of the shellac or the destruction of the starch. thus by several layers one within the other larger conductors and greater lengths and therefore greater mass may be used without lowering the resistance or increasing the radiating surface. The plastic carbon with lac may be mixed with powders regulated so as to allow of it being handled without breaking or a thread may be used the whole sealed with the plastic compound and rolled out the thread above the whole (even when the mass of carbon assumed it is weak) to be handled without fear of breaking. An iron wire might be used and thickly coated with the plastic material and carbonized the shrinkage would of course produce cracks but these could be filled up of plastic carbon and the whole spiral recarbonized, with platina contacts. Afterwards the iron wire could be taken out by acids. Even platina wire might be used. Spirals and different forms of burners may be obtained by carbonizing regulable fibre such as wood, cotton, etc. If a thread is formed to the platina wires by a little of the plastic carbon and the whole carbonized and subjected in a closed chamber to heat the thread and plastic material will be carbonized

and become a conductor. one half inch of thread will offer a resistance generally of 100 ohms, but of course the resistance will be variable as a whole and in different parts of its course and light is costly, hence it is better to increase the conductivity and length to enable one to obtain lamps having nearly the same resistance one inch of such composed of eight of the fine threads is well worth with the platina lamp blocks filled and secured to the platina conductor as heretofore described. But after carbonization is sufficient seems for practical use but has only a resistance of 20 ohms hence a greater length than one inch is necessary to attain 100 ohms and so to prevent a great increase in the radiating surface it must be coiled or otherwise arranged. The conductor of platina in an ordinary vacuum standard is consumed in a few minutes but if sealed in a glass bulb and the air exhausted by a Sprengel pump provided with a chemical drying tube filled with pitch, sulphuric acid, a phosphoric anhydride and a tube with finely divided copper for absorbing mercury vapor and the exhaustion carried to a point where the McLeod gauge shows the pressure to be at least $\frac{1}{500000}$ of an atmosphere the carbon may be brought up to a point where although giving a light of 3 gas jets is absolutely stable notwithstanding its fragile nature, paper may be substituted for the thread Vulcanized fibre which is paper wood and used. the contact with the platinum wires being made by the use of the plastic carbon. In fact any substance which will give a frame work of carbon when subjected to heat within a closed steel tube may be used. I am now engaged in perfecting methods for the rapid and economical manufacture of these conductors which will be the subject matter of patent applications.

U.S. Caveat and English Provisional Protection
Dec. 19 1879

In my system of Electric Lighting I have proposed in a previous patent to regulate the pressure or electro motive force at the central station by varying the strength of the field magnet around the induction bobbin connected to the main conductor thus rise or fall in the electro motive force due to putting on or off Lamps being indicated by an Electrometer. I find that an electrometer similar to that of Weber but of high resistance is an improvement upon the electrometer owing to its greater reliability. Two of such are used and connected across the main conductor in multiple arc.

In my system a city is divided up into districts in each district there is a central station which station is provided with sufficient motive power and electric generators to supply half a mile radius of this station I employ say five engines each of 250 horse power each belt runs by what a separate line of shafting on this shafting is billed say 40 electric generators so that each engine and its system of generators may be considered complete within itself. Large rods of copper are conveyed in proximity to all the generators and connecting levers are arranged so that any generator may be placed across and feed into the two main conductors. All the generators when connected to the mains are connected in multiple arc and the field magnet of any generator is so wound on the edge of the pulley upon its shaft made such a diameter that either by increase or decrease of speed or by a weakening or strengthening of the field magnet the electro motive force of the induction bobbin may be adjusted to name exactly the same electro motive-force as all the other machines. I employ several subsidiary electric generators fitted on the shaft of the first engine which are all in use and the current from these machines is conveyed by leading wire to the field magnets of all the generators and serve to keep a constant field. A second wire of these subsidiary machines is connected to the shaft of the second engine and connected in duplicate to be used in case of

emergency or in case where the first engine stops. A switch serving to change the subsidiary generator from one set to another so the change can be made gradually.
The subsidiary generators are also arranged in multiple arc but the field magnets of main line generators are so connected that there will be a set of say ten magnets connected in series and five set connected in multiple arc. whether arranged in series say ten field magnets are disconnected at once the induction bottles having previously been disconnected from the mains.
To energizing the field magnets of the subsidiary generators I use a Dynamo Electric Machine the current from which passes through the field magnets of all the subsidiary generators either in series or in multiple arc in the circuit I place a large number of resistance coils of large wire and subdivided so that each five say 50 of six ohms, a wire between each resistance coil leads to a rotary commutator which in turning short circuit a greater or lesser number of resistance coils thus increasing or decreasing the strength of the current in the field magnets of the subsidiary generators This in its turn increases or decreases the strength of the current in the induction bottles between them, and the current in its turn increases or decreases the strength of the field magnets of the main line generators and causes a rise or fall in the pressure or Electromotive force of the current according as more or less energy is drawn from the stations by putting on or off Lamps or electric Engines.
Thus I am enabled to cause a raise or fall in the pressure or Electro motive force by turning of the commutator handle.
To indicate the rise and fall of electromotive force the operator at the commutator has before him the Electrodynamometer as well as several standard Lamps to indicate the rise and fall.
This apparatus I propose to place in a room disconnected from the main Rooms containing the generator and engines commutator therewith being made by some but the movement of the commutator is transferred by gearing and shafts to a large dial placed one in the generator room and one in the Engine Room so that the station master may know the proper time to start

up or stop down one or more of the engines. It will probably happen in practice that from the breaking of belts or a wire or other cause that a generator will cease to pass electricity to the main although the induction bottom be intact this will cause the current from all other generators to cause their generators to reverse its motion and perhaps burn the wire, to prevent this I interpolate a short wire in the induction bottom current made of bismuth fusible metal which will melt and save the wire of the generator before too great a heat is reached. Between each generator I place a loose pulley on a stand upon an upright upon which the belt may be thrown in case a generator is to be stopped when the battery of generator of which it is one is in use
It is well known that at different parts of the main circuit outside of the generator electric Engines almost similar to the generator may be placed for the purpose of giving rot power to shafting. I find that Engines giving varying amounts of power from 20 horse to 20 of a horse may all be worked in multiple arc. The less the power required the smaller the machine and the greater length and a finer wire used than that for a larger power. And I find that it is preferable to place the greatest length of the wire and resistance upon the field magnet. In using these small machines in multiple arc for running a sewing machine I arrange a switch for disconnecting the machine from the circuit, a belt to connect the motor with the sewing machine using a very small pulley on the motor and a large pulley on the sewing machine so as to allow of high speed in the motor I regulate the speed of sewing by a friction lever pressing on the driving pulley of the sewing machine which lever being connected to the foot rest may be pressed lightly or heavily on the pulley of the sewing machine and thus increase or diminish its speed instantly or stop it all together. The pulley of the motor being a friction pulley allows the motor shaft to revolve at a slower speed even when the belt is stopped. When the motor is arranged to pump water to a tank I use a float which when the water becomes too low closes the current and connects the motor with the main line and when the water is sufficient another float serves to disconnect the motor from the circuit for running

machine shaft with these motor cords where an non spin is required I arrange upon the shaft of the motor a governor working in the ordinary manner but which when the speed has reached a certain point causes a lever to open the circuit and disconnect the motor from the circuit.
These motors work upon the same main conductor as the lamps

The object of this invention is to obtain light by the incandescence of electric conducting matter.

The invention consists in various methods of manufacturing the lamp

I have found that when paper is used that it should be specially manufactured so as to obtain pure carbonizable fibre without sizing and other foreign materials. Ordinary British board contains Rosin & other ingredients for making it non porous to ink this resin carbonizes as well as the fibre and being in some lots of paper in quantity or lesser quantity makes it very difficult to obtain incandescent conductor of the same degree of conductivity when subjected to the same carbonizing pressure. To obtain this I obtain paper free from sized matter and after cutting the pieces of paper to make the conductor in a larger form than the final cutting I soak these in a solution of sugar in alcohol or Alcohol & water or in a water solution of sugar. The strength of these solutions must be such that the required resistance is obtained if a low resistance is required a thick solution of sugar should be used and if a high resistance the strength of the solution must be diminished. The form shown in the form of burner which I have shown in an application has thickened ends which serve to make good contact with the clamps. I now cut out another piece or two pieces of a shape exactly like these thickened ends. I place one on each side moistening them slightly with a syrup solution of sugar this serves to hold them in their position and when carbonized the sugar carbonizes as well and these make a solid piece which allows of better clamping

I also have succeeded in plating these ends with copper, nickel, & other metals, which serve to make excellent contact between the clamps and the ends. I effect the deposit by hanging the loops upon a wire which is connected to one pole of a battery and allowing the ends of the loops to dip in the plating solution the proper distance, the jar containing the plating solution being in contact with the other pole of the battery. In using long fibre such as manilla hemp and other fibres of the hemp family I also plate the ends very thickly and afterwards drill holes in the metal deposited by electro deposition

tap the same end, set in a short length of platina wire. This wire is secured to the platina wire passing through the glass by a collar or clamp.

I make lamps consisting of several fibres each spread out but all coming to a common clamp but in this case the aggregate radiating surface of all the fibres do not exceed that of a single paper bamboo conductor. I also bunch all these fibres together & pass the aggregate filament through a solution of sugar to hold them together. A single end wire or an aggregation of distinct fibres I secure their ends to a piece of carbonate wire such as Lamine Wire, for wire occurant Black fibre by drilling a small hole in the wood & inserting the fibre through this hole and pulling a slight connection of sugar on the wood, the whole is carbonized and gives a good obstinate end for clamping a short piece of platina wire being placed in one end of the mould when the fibre is carbonized, the wood shrinking tends to clamp itself upon the platina under great force. In these clamps of carbon contain a large quantity of gas which some not very easily in the vacuum. It is fair to assume clamps of carbon which have been carbonized and subjected to high incandescence in vacuo to run it free air. Small pieces can then be used with fibres for wide a very small ~~carrying~~ quantity of sugar passing to hold the fibre & the clamp in the act of carbonization. Paper bamboo shows a burner made of fibre may be (after carbonization) placed in combination tube in platina wire and a hydrocarbon vapor passed through the tube by the aid of a Bunsen water vacuum pump. The hydrocarbon being decomposed a very hard carbon is deposited upon the shaped conductor. The most perfect fibre for carbonization and use for lighting by incandescence or for arc purposes, is a fibrous grass from South America called Monkey Back fibre, each blade of grass which are generally found is composed of a great number of fibres and the whole cemented together with a natural resin which serves to carbonize and lock all the other fibres together, making a nearly homogeneous filament. These blades of grass are of various size from 1/10 of an inch in diameter to 1/100 of an inch, they are slightly tapered. I

I make a cutting die through which I pull the fibre the sage of the die serve to shave off the outer matter of the thickness and another plane is to use a revolving cutter the cutter revolving and is passed along the fibre. These fibres when since may be put between paper ends which are sugared and then carbonized or a small platinum Iridium wire may have a hole drilled in the end about the size of the fibre after carbonization the wire is split to the bottom of the hole or borer, the fibre is placed in the hole and if the interior of the wire is made slightly taper a ring may be placed over it thus clamping the fibre very tightly

In carbonizing we mould we have sometimes dispensed with the tissue paper between each of the paper shoes or fibre shoes with the weight on top and instead made a small indent into a nickel plate having a depth a little greater than the thickness of the paper over this another nickel plate is placed of a paper shoe is placed in this mould and the top plate put on it lays in a very thin chamber, but is free to contract, the two plates are placed in the middle bar and then passed through the carbonizing process the shoe will, being free from restraint contract in a somewhat irregular shape but it will have less time and withstand a higher incandescence. As platina continue to a certain extent with heated carbon I let into the moles of my clamps the plate of Iridium which does not to the same extent combine with carbon gold chromium manganese chrome iron, silver and many other metals may be substituted for the Iridium but whether they will last for long periods of time I am now ascertaining.

I sometimes roughen the surface of my platina clamp so as to ensure better contact. I also instead of placing the tightening screw some distance from where the carbon is clamped, cut a hole in the thickened part of the shoe before carbonization and then place the shoe in the clamp and put the tightening screw through this hole. I have found a small spiral which forms a sort of a cup and secures one of these spirals to each of the platina wire which are sealed in the glass, in this cup. I free the round carbonized wooden ends of the fibres. In distributing both power and light & where there is a difference of price to be charged for electricity when used for light ~~and~~ power. I place a double meter in the house

This consists and consists of the leading wires of the light to one pulley and extra leading wires to the magnetic motor to another pulley. As the motors will to different purposes be required to run two or three, & vibrate each with a pressure which when the same increases above a certain rate force the circuit and disconnect the motor from the main wires, and as it falls in speed close the circuit again as it would be entirely impracticable to use an ordinary one point circuit breaker and strong magnetic governing to the great spark due to the extra current of the induction within the field magnet & use several points and springs so arranged that the circuit is broken simultaneously in several places and this is reduces it in any one single point as to practically obliterate it as far as any great destruction of the contact points are concerned

It is obvious that the power may be run on the main shaft of the motor or separately, motor being run it by gear wheels worms & wheels or belts connected to the main shaft

There is a defect in the slow carbonization of organic filaments as then Hydrocarbons are alternately evolved in carbon and are only decomposed by the highest incandescence and after a long period of time to obtain a more capital carbonization I take a large platinum iridium wire bend it in the form of a horse shoe, form a groove on this wire two or three times the size of the fibre which is to be laid in it after this is done I put in a piece of the platinum iridium which was to cover the slot in which the fibre is laid, the ends of the horse shoe are secured to circuit clamps & the whole arrangement is placed in vacuo the wire is slightly heated to drive off the water vapor then brought suddenly to incandescence to effect the carbonization carbon may be substituted for the platinum iridium, even viscous substances may be carbonized in these grooves, such as sugar must be melted in tissue paper to prevent it sticking to the platinum iridium.

Menlo Park

T. A. E.

The object of this invention is to transmit sonorous vibrations into electric waves for telephonic purposes.

The invention consists in the combination of various finely divided conductors with suitable mechanism that such translation may take place.

Fig 1 shows my present form of transmitter for translating the sonorous waves into electric waves.
A is the case, B a vulcanite cup in the bottom of which is a plate of metal C preferably of platinum but it may be of any metal. Over it a button of finely divided conducting matter, connection being made to the button by a metallic ring as in figure 2. Upon this rests a button of finely divided material which conducts electricity. On this button rests a plate of metal E or button of finely divided conducting material connection from which is made by the ribbon F. The base is connected to one wire and the top plate F. These are included in the circuit of the primary wire of an induction coil.
G is a plate which rests on contact with E and serves to condense upon it the sonorous waves. This plate is fastened to the case. This plate is not necessary when sonorousness of adjustment is more desirable than loudness for the sonorous waves may impinge directly upon the sensitive tension regulator itself as in fig 3. In this case B is the case, C is the bottom plate, D the button of finely divided material, E a plate with turned up edges to prevent spittle from coming in contact with D. F is a spring to hold the plate E in contact with D when in various positions. G is the mouth piece. The operation is exactly the same as the apparatus in fig 1 the sonorous wave striking the plate E produces a concussion and causes a greater number of points upon the button D to come in contact with E the number of course being proportionate to the strength of the sonorous wave. After long experiment I have ascertained

that the principle upon which the electric current is varied in strength by the action of sonorous or other vibrations acting upon finely divided conducting matter is due almost entirely to the greater or less number of contacts or points which come in contact with each other or with a metal plate. For instance in the case of a lamp-black button 3/4 of an inch in diameter I have calculated by comparison under a microscope with a Rutherford grading that there are not less than ten million particles of Carbon on each side, hence if the button is included in a current between two metal plates with a certain initial pressure four million particles will be in contact with the plate, and these points will offer a certain resistance. If now the pressure on the button is gradually increased 5, 6, 8, 10 millions of particles additional will be brought in contact thus reducing the resistance owing to the almost infinite size of these points the internal contacts making so infinitesimal a rise and fall of tension by themselves the sounding magnet is unable to follow them and they are not heard and it only responds to the rise and fall of tension taken as a whole. In the case of a less finely divided substance the particles may be so few in number and the button so insensitive that these internal contacts are heard as well as the main waves. In this case the speech received is harsh and disagreeable. It follows that any substance which is a conductor may be finely divided either by chemical or mechanical means and placed in suitable forms (either with or without non-conducting substances to give the required elasticity). It follows from what I have above stated that lamp-black Carbon is preferable to any other substance owing to the fact that of all conducting substances which I have so far tested it seems to be the most finely divided, hence it gives a fine wave and it also gives the greatest variation in the strength of the current by a given wave than any other substance. It is not oxidized at common temperature and does not absorb moisture. Carbon in the form of Charcoal, Coal soot, graphite,

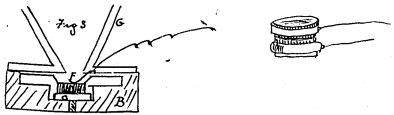
Carburet of iron, gas retort carbon, all have larger particles. Iodide of Copper, Peroxide of lead, and black oxide manganese seem to be the best. Of the finely divided metals those which do not oxidize are preferable such as gold, nickel, ruthinium, osmium, iridium, palladium.

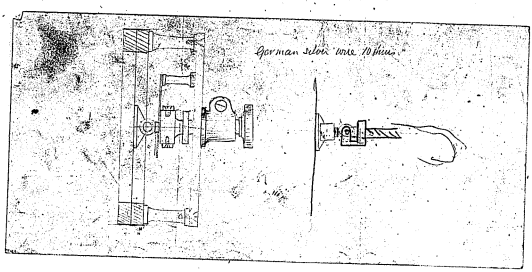
Many of the oxides give very good results such as protoxide of Copper and iron, also many sulphides, such as sulphide of lead, copper, iron, nickel. Even a metal such as platinum rolled like a diffraction grating used in spectrum analysis, but in both directions at right angles, gives an enormous number of points and produces fine results, especially when the metal is thin and elastic. I do not wish to confine myself to any substance to be used, neither do I desire to confine myself to any particular device for holding the finely divided substance or to any particular form of substance or limit myself to one piece, as such finely divided substance may be mounted in innumerable forms, and includes in and may be form part of a circuit in many ways and diaphragms, tables, resonant boxes, or the substance itself may receive the sonorous vibration, several pieces may be mounted in one circuit resting one upon the other.

I claim – The use of pieces of finely divided conducting matter forming part of an Electric circuit for transitting sonorous waves into Electric waves for telephonic transmission.

2d The transmitter constructed and operated substantially as described.

Fig 1 is the model



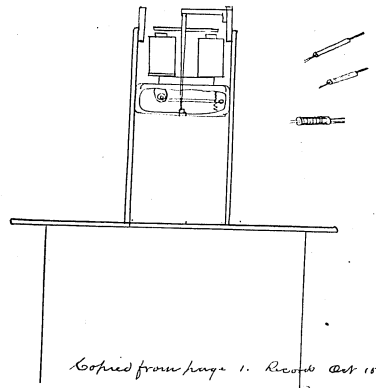


[ITEM FOUND IN BOOK]

Experimental Researches, Vol. 6, Cat. 998

This volume contains drawings of "Electric Engines" for the electric light and an "Electric Draft Lamp" copied into it by William Carman in October 1878. The originals of this material can be found in NS-78-005, Unbound Notes and Drawings. Only pages 1-4 of this 640-page volume have been used.

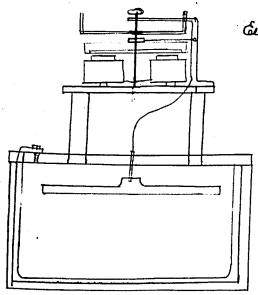
Electric Engine for Lamp



Copied from page 1. Record Oct 15. 1878

W Cumming

Electric Lamp Engine Oct 9. 78

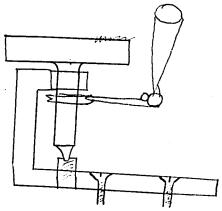


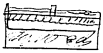
Copied from page 2. E Lamp Record Oct 15. 1878

W Cumming

Electric Engine Lamp · Aug 29. 1878

Miscellaneous

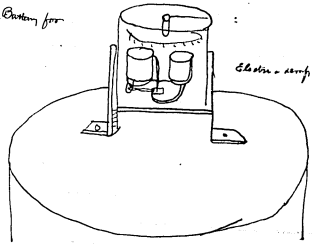




Battery for

Electric - lamp Work

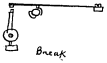
Cylinder



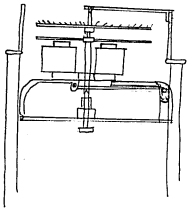
Copied from page 3. Lamp Records Oct 16. 1878

W. Carman

Electric Engine for Lamp Sept 9. 1878



Break



Royalty

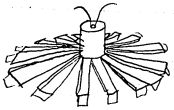
Royalty

Copied from page 4. Lamp Records Oct 16. 1878 W. Carman

Electric Engine for Lamp Sept 24. 1878

Mr Kremer - will you please make a fine for this battery that has all side surface something like this with no bottom surface hardly but all side surface

Batchelor



X - internal resistance

X + 1-44 ohm - 48°30 degrees

X 1 1-44 ohms a 10 ohm - 82:20

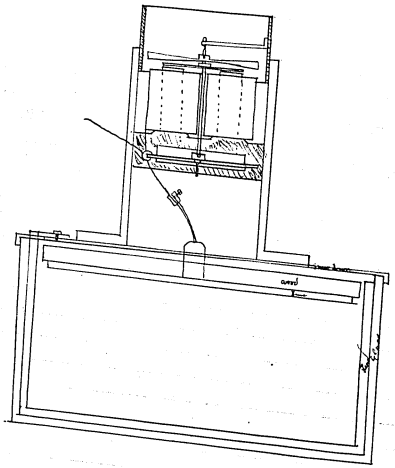
Do 58 ohms

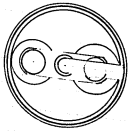
Copied from page 5. Lamp Records Oct 16. 1878

W. Carman

Electric draft lamp Oct 9. 1878

made by Jackson





Looking from Pages. Elec draft lamp Oct 16. 1878

W Conman

UNBOUND NOTEBOOKS, VOLUMES 8 - 18

Volumes 8-18, covering the period 1875-1879, are collections of unbound notebooks relating to etheric force, acoustic and multiple telegraphy, the telephone, phonograph, electromotograph, and electric light, as well as a few other subjects. The documents are identified by page/volume numbers written on the back of each page, often in red and blue pencil. The notebook page number has been filmed below each document.

Most of the drawings and notes were originally made in soft-cover tablet notebooks. Edison's staff subsequently removed the pages from the tablet notebooks so that material relating to the same subjects could be gathered together and so that tracings could be made. Numbers in the upper left corners of some of the pages indicate that tracings were made for those pages. (See Edison's testimony, Telephone Interferences, Litigation Series.)

The page/volume numbers were probably assigned in 1880, after the Patent Office declared Edison's telephone patent applications to be in interference with those of Alexander Graham Bell, Elisha Gray, and several other inventors. In letters of February 16, 1880, and April 1, 1880, Edison's patent attorney, Lemuel Serrell, suggested that one of Edison's assistants "sort out the drawings and evidence according to date" and "lay out all matters relating to Telephones." Serrell would then go over the material with Edison and "number and list the drawings."

The drawings and notes that were taken from Volumes 9-15 for use as exhibits in the telephone interferences were probably never returned to Edison and are not at the Edison National Historic Site. However, facsimiles do appear in the printed record of Edison's exhibits. (See Telephone Interferences, Volume 2, Litigation Series.) In some instances when an item was removed, a note recording the page number, the interference, and the date was prepared and inserted into the sequence. By correlating the numbered drawings and notes at the ENHS with the exhibits in the printed record, it is possible to reconstruct nearly the complete numerical sequence of Volumes 8-18.

Although the drawings and notes used as exhibits were intended to establish the priority of Edison's work on the telephone, material relating to the phonograph also appears in the exhibit volume. Readers interested in the development of the phonograph should examine this volume along with other documents relating to the phonograph.

Other notebooks at the ENHS may at one time have been considered part of this series. There are bound notebooks among the Miscellaneous Shop and Laboratory Notebooks that are labeled "Vol. 2" and "Vol. 5" (Cat. 30,094, Cat. 30,095). Another bound notebook (Cat. 1175) may have been Edison's Volume 7. Its pages contain penciled page/volume numbers similar to those in this series.

The following volumes comprise this series:

Vol. 8	(1876-1877)
Vol. 9	(1875)
Vol. 10	(1876)
Vol. 11	(1877)
Vol. 12	(1877)
Vol. 13	(1877)
Vol. 14	(1878)
Vol. 15	(1875-1877)
Vol. 16	(1878-1879)
Vol. 17	(1877-1878)
Vol. 18	(1878)

Notebook, Volume 8

This volume covers the periods July-August 1876 and January-February 1877. It is divided into two parts, each consisting of a series of soft-cover tablet notebooks. Part One contains nine notebooks, encompassing pages 1-256 and covering the period January-February 1877. Part Two contains four notebooks, encompassing pages 257-363 and covering the period July-August 1876.

The notes and drawings in Part One are primarily by Edison. Others are by James Adams and several were witnessed by Adams and Charles Batchelor. Most of the notes relate to etheric force investigations; experiments with ink and paper, including ink for the blind; and electrochemical experiments. There are also notes on electromotograph experiments; drawings of the autographic pen and press; and notes and drawings for the design of a mirror galvanometer. The last page of Part One refers to the speaking telegraph. Most of the experiments are chemical in nature and a number of pages appear to have been damaged by chemicals.

The notes and drawings in Part Two are primarily by Edison; others are by James Adams and Edward H. Johnson. They relate primarily to experiments in acoustic and multiplex telegraphy, the use of the electromotograph for telegraphic purposes, and experiments with batteries for sending telegraph messages by submarine cable. There are also notes and drawings of electrometers and galvanometers.

The notebooks are arranged in the following order:

Part One

1) "No. 1," pp. 1-36, January 11-12, 1877.

2) "No. 2," pp. 37-71, January 12-13, 1877.

3) "No. 3," pp. 72-107, January 13, 1877.

4) Unnumbered, continuation of "No. 3," pp. 108-125, January 14-16 and February 3-13, 1877.

5) "No. 4," pp. 126-160, January 17-21, 1877.

6) "No. 1 - Platina Solution," pp. 161-182, January 21-27 and February 14-15, 1877.

7) "No. 5," pp. 183-208, January 23, 1877.

8) Unnumbered, pp. 209-232, undated.

9) Unnumbered, pp. 233-256, February 2-14, 1877.

Part Two

1) pp. 257-280, August 2-6, 1876.

2) pp. 281-319, July 30-August 9, 1876.

3) pp. 323-334, August 3, 1876.

4) pp. 335-363, August 6-22, 1876.

Pages 320-322 are missing. These pages were used in October 1880 as exhibits in an interference proceeding involving Edison, Amos E. Dolbear, and George L. Anders. Photolithographs of the original drawings can be found in the U.S. Patent Office Interference Files, Box 1103, Record Group 241, Records of the Patent Office, National Archives and Records Service. Photocopies of these facsimiles have been microfilmed to complete the volume.

The following pages, containing only samples of duplicating ink, were not filmed: 218-229.

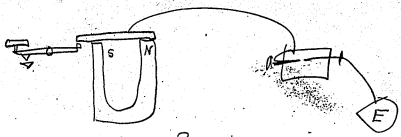
Blank pages not filmed: 70-71, 75, 121, 125.

Experimental
Notes

Thomas A. Edison

Jany 11 1907

Ether is



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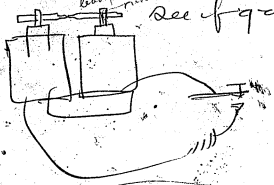

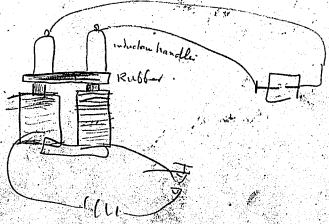

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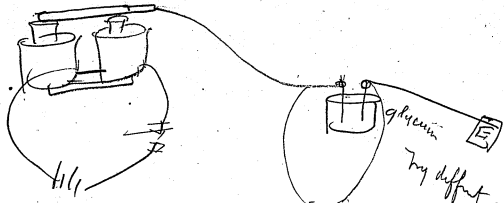
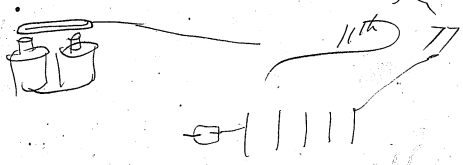
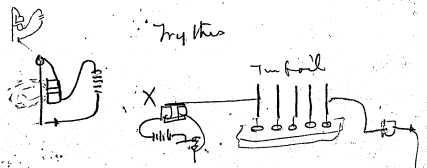


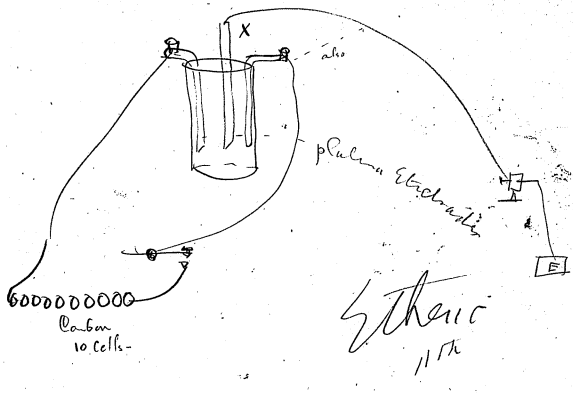
Ether





A X. try magnets of very high & low resistance with high & low R batteries to see if Ferson measure or the orientation by moving tinfoil plates.

2

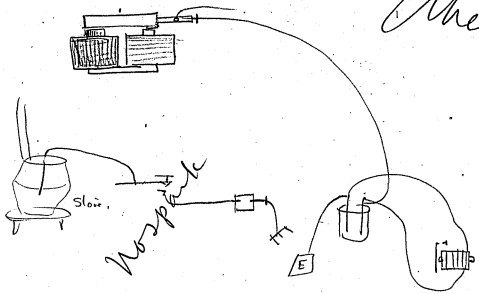


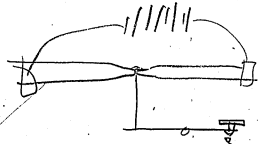
Etheric
11th

Place in the cell different solutions. moving X to one side or the other or taking it out altogether & connecting Etheriscope direct to one of the Electrodes.

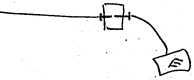
3

Etheric



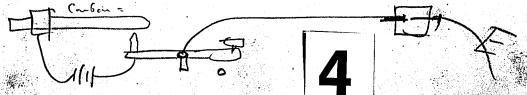


The Etheric Spark may be a molecular vibration set up in wire by Electric Spark.



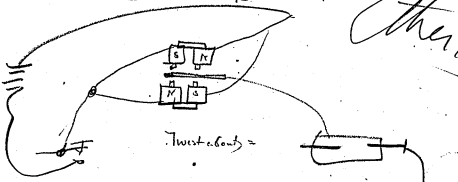
Carbon powder Electric Light

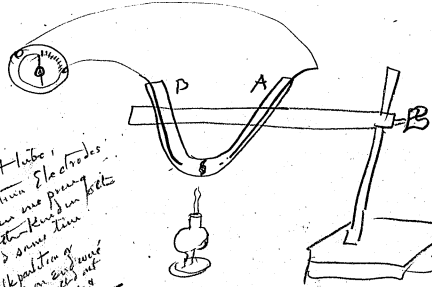
Key brings wire into Light also.



4

Etheric





Bent tube:
Platinum Electrodes
1 Sol on one prong
can other King on pole
powders show time
chalk partition or
opaque or diffusant
(Wheatstone's pulse net
Eng. Apparatus)

5

Johnson

Thos A Edison

Chas Batchelor

This page is a fair sample

James Adams

Mem

Nothing in it

Memphis

Hopefully yours

entered into this.

Chas Batchelor

Chas Batchelor

entered in in into

Chas Batchelor in into this tenth

Chas Batchelor

Now is the winter of our discontent

Now is James A Johnson

James

Now is the winter of our discontent made glorious

summer by this son of York

A Johnson

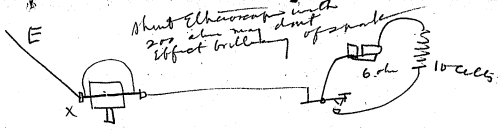
Now is the winter of our

James adams

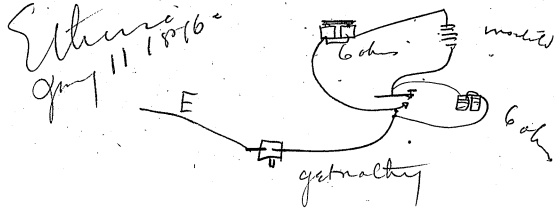
Chas Batchelor

Thos A Edison

6



get spark with stationary electrodes
when I put my hand at X,

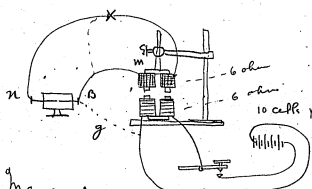


I have ~~noticed~~ noticed with the Carbon points, that no matter how powerful the spark is there must be a chain of Carbon particles touching Each other = If I separate the points a little distance and blow very hard on them, thus cleaning them of particles I cannot obtain the spark until I have brought points in

Contact and withdraw them, the spark is weak though I do not get it with full brilliancy until I have brought the points together & worked them so as to grind some of the carbon particles off - when considerable have been ground the points may be operated 1/32 of an inch apart the spark is weaker & uncertain but if a gentle blow is given the spark disappears & can not be made to appear until the points are again brought together

Also while sparks are passing between the two points, another set of points will give sparks also of equall brilliancy without diminishing those in the 1st points it is probable that 1/2 a doz or doz points might be made to give sparks.

8



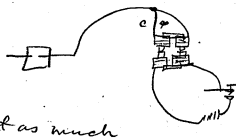
In contact get brilliant spark absent at point of the Etherscope. sparks gradually dies out until when inch away get it feeble. Proceeding get the shock is violent at the tongue when inserted in Coil at X. If now Magnet M be detached from the dark box & the dotted line wire g placed in Connection the spark is at once brilliant ~~almost~~ equal to that from M when it is laying on the Cores of the energized Magnet only separated by a piece of paper yet no shock can be perceived at g = the ground ~~[illegible]~~ was connected ~~[illegible]~~ from n with no great value after

9

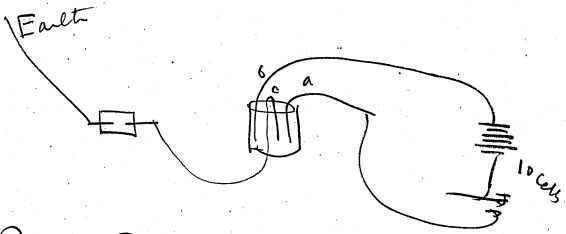
get just as much spark, whether

X wire is disconnected or connected
when M is much away

when M is in actual contact
with coils of other magnet,
& its two wires taken from dark
box & put together and a single
wire run to B. thus



get just as much
spark by disconnecting c get
same thing is when this
connected either from other
magnet =



Platinum Electrodes,
c Electrode being connected to the
Electroscope = by very fine manipulation
of point got several sparks
but that was during 1/2
hour manipulation =
Bichromate Potash in Cell 10 gm
in 100 cc H_2O = Warmed
c towards a, & b, consequent
on ~~whether~~ where c was when
got sparks =

11

8 gramme Sal
No 2. Borate of Soda in Cell,
Couldnt get a spark
10 minutes manipulation

40 gramme Sal
Sulphate Magnesia
Couldnt get a spark
10 minutes manipulation

20 Grammes in 100 cc H O,
Pyrogallic Acid = nothing after
10 minutes manipulation
Resistance very high Coil
Charge magnet with pyro in cell
strong Enough to get Ethereal
in usual manner =

20 gramme Bicarb Potash
No spark =

12

I have noticed that the gas given off on the Electrode connected to the zinc pole of the Battery in the Bi Carb Pot which is poly Hydrogen is composed of very fine bubbles & of great number whereas in the other pole the bubbles are larger & much fewer of them - but they shoot up to the top of the solution with greater Velocity & so it not possible to deduce from this the size of the H & Oxygen atoms, (i.e. relative size) so it that the specific gravity of the infinitely fine Oxygen bubbles by so much greater than the H bubbles retain them hold on the Electrode. being thus allowing a number to coalesce & run into Each other this would account for the difference in size.

= I notice today that aluminum with Carbon in Sol of Sal ammon.

there was formed an immense number of gas bubbles varying apparently superimposed in the other (appx) 1/16 inch thick they appear to cling to that metal with remarkable tenacity they may be slid up & down in the aluminum with a point under the solution without detaching them in fact it is very hard to detach them no amount of shaking will clear the plate of bubbles - this probably accounts for the remarkably polarizing properties of the metal as shown in Exp 9 Experiments -

It was Carbonic acid gas given off on the Electrode Connected to Coke - it put a light out =

14

5 gramme
Licorice -
Nothing =
forms gas on Electrode Connected to Carbon which collects in masses in the Acetic solution & Comes to the top in lumps like the Curds of a precipitate =

---

8 grammes Bi Carb Soda -
Nothing = Bubbles on both appear to be larger than with Bi Carb Potash, but that was a 20 gramme sol, that would seem to prove that the weaker a solution or the smaller the amount of decomposition the larger & slower the Bubbles were formed & detached, hence this might explain Galle's paradoxical to a certain extent)

Nitrate. Potash 20 grammes
No spark =

Notice that Electrode Commenced
to Carbon gives small bubbles which
run into exceedingly large ones
they only coming to top slowly
they hang Electrode persistently
after current open on Electrode
Commenced to 2 mi, Bubbles
smaller ~~dont~~ run into each other
in the least apparently have
no affinity = on opening the current
the bubbles gradually rise & it
take sometime before the
plate is clear, = after ckt
open 5 minutes bubbles come
out of the platinum quite copiously
if it is cleared of bubbles by shaking
they immediately commence to
pour out of it = This is not

16

The case with the Electrode connected to the Carbon which remains full of large bubbles & now shake it, it becomes clear in 2 minutes it collects some large bubbles but they do not rise & the other Electrode still continues to pour out ~~the~~ bubbles. But not so copiously =

20 grammes gum Arabic Nothing =

The bubbles formed in the solution leave the Electrode with extreme slowness hence it wouldn't be a good depolarizer for a battery if any one had the insanity to use it for that purpose

Discovery

In decomposing with the Electrolysis (platina) & the 10 cells Carbon battery a 20 grammes sal of Bromide of Potassium in 100cc/H0 ~~[illegible]~~ it occurred to me seeing the great volume of gas arising to form "Vortex rings" like the smoke rings to carry out this idea a No 20 Copper wire in form of a loop then on insulating it possable rings were made when the loop was immersed a proper

distance in the solution = too deep
breaking them up by forcing
one into the top - while
watching these rings heard
a sound Every time closed
Key = after attention was
called to it found it was
very loud and could
read morse by it 10 & 15
feet away = found that
by putting ear near cell
that could read morse
through resistance of 1000
ohms = found that it made
a difference in size of ring
straight wire dont give sound
a wire bent at right angles
gives it nearly as loud
as ring =

found that placing ring in particular part of solution got it louder = ~~but~~ keeping the key ~~continuously~~ closed the sound was a vibrating one, like a tuning fork making about 40 per second — by pushing loop down lower in liquid & in fact up & down could get different tone = tried piece iron wire in end of Copper wire in a loop = it was fine wire = gave it very good = thought plating a wire nearly ditto 1/8 inch wide sheet aluminum The new wire after being in use a month commenced to give off bubbles after current ~~[illegible]~~ opened & continued to do so for 5 or 6 minutes until took it out probably the absorbed Hydrogen

Bromide Cadmium gives off
no gas = Cadmium deposition on
Hydrogen Electrode & Bromine at
pre on. Oxygen = perhaps.
Cadmium & Zinc might be used
for a battery. Brom Cadmium
used instead of Sulphate of Cu
in Callandbattery =

Phosphate ammonia 5 gramm
Curious = with bent loop
Copper wire = it works quite
plain but giving a ultralty
sound like Brom Pot = but on
opening key there is a short
after sound like the frying
on lard in a frying pan
I reversed the battery
so that Ox would come

21

on the copper loop heard
nothing of the regular signals
but the hard frying pan noise
was there & heard only after
opening

Chlorate of Potash 8
grammes — very hardly
not sharp. only hear it when
loop is near top of water.
We notice that H leave loop
much sooner than O leaves
platina & get full quicker.
this explains why H is
best for producing a mark
on chem prepared paper for
Auto Telegraphs

get over

1 gramme
Formate of Copper =
No gas - deposits Cu on day

1 Gramme Citrate of Potash
Best yet = Very strong can
hear it myself 2 feet away
= the lower the loop is
immersed the greater the
sounder of brought near
(1 inch) top of liquid hear
nothing = its like land fry
but clear + sharp quite
beautiful Morse = but dont
know if it as delicate as
Bromide Kali = ought to
have a 10 gramme w. meas
Solution =

23

There is something Curious ~~[illegible]~~ about the Looped wire = if you use a Rubber Coated wire just heavy Slight but Capp not to seem Capp fone wire loop to you can hardly feel it = if you use a No 2/0 bare wire ~~[illegible]~~ with loop it not good. but if you have the No 2 wire Coated loosely with Cotton & bare near tip & bend to a loop, its loud again = fine wire wire works well = the loop is not necessary as it shaughlend it but it worked well though the Sound appeared to be different =

flap over

24

2 grammes
Tartarate Soda
Equal of nat the best

Tried a deep hydrometer glass
full of Salt water — immersed
Electrode deep gave could
hear it faintly but I couldn't
hence no good not because
I couldn't hear it but because
if I couldn't it wasn't worth
a damn

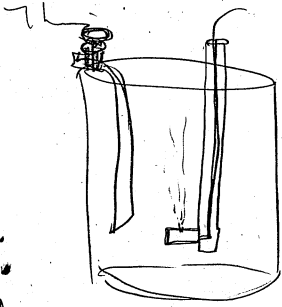
Tannic Acid 10 grams
Hear it myself with Em to
cell but not good = 1 hunte
reason is due to high
Resistance of Tannic Acid

Sulphate Zinc 20 grains
gives a higher note & very
nice & sharp. its loud too.
but alas the unit Cu soon
deposits Zinc & then the
Duet music stops =

Chromic Acid ¼ gram
Can just hear it mix quad

It is probable that if an
Electrode Cu made thoroughly
insulated except at the
End & that be provided
with a copper ~~tap~~ tube
~~with~~ closed at the End & the
outside entirely insulated

having small hole drilled in tube so that gas is formed inside and must escape by this orifice that will produce a greater noise and give any note required



Sulphuric Acid & H O

Very strong poly sharpest dont hear it on 1000 ohm

1 ounch = perhaps Electrode Bad =

Hydrochloric Acid ~~at~~ HCl,
First Class

New Discovery

If a piece of Carbon points for Electric light be held in the hand and inserted in the liquid one Electrode being platina & connected to the Carbon of the battery & the other being a piece of No 2 lose Copper wire in iron ~~loop~~ loop and the Carbon allowed to touch the platina it will when entirely disconnected from it as far away as can be give a spark by touching the iron wire of the loop under water

28

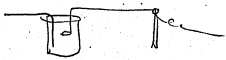
Quizwork 6 am

We Recommence work. at 2 PM

January 12 1897

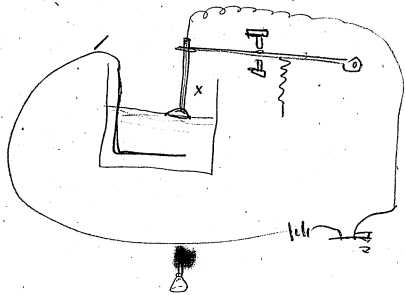
The idea has occurred to me seeing the great volume of gas given off by Electrolysis in proper solution and its suddenness that by the use of a proper cylinder & valve that more power could be obtained by Electrolysis than through the intervention of magnetism =

I have noticed that the Electrode having the looped wire on its end is arranged thus



is moved up and down by closing the current (1-2) up on closing being buoyed by the gas = The idea has occurred in this connection to make a gas relay for lighting

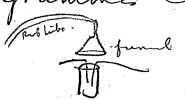
Thus



X being a hard rubber funnel with a funnel end. inside is lined near top with platinum; connected with the battery by fine wire running through X. the thing floats dipping slightly in H_2O, if ckt is closed gas pressure lifts stop to a point where gas escapes - or a reverse current might be sent when it accident escape recombination probably would take place =

30

20 grammes Caustic Potash.



Very good first class. can hear the plan with funnel $1\frac{1}{2}$ makes any from Cell = = Think this solution with small wire platina loop in Copper Electrode was to best yet except perhaps HCl =

20 grammes Hyposulphate Soda First Class Equal to any =

20 grammes Iodide of Potassium Not quite so good as above =

20 grammes Common Alum Not very good as Iodide. hear plan though = large Bubble in H = "

1 gram Camphoric acid
Has nothing at all probably
because resistance too high

Ferrocyanide K. 20 grammes
have nothing Extra = few bubbles only

Nitrate ammonia 40 grammes
have when ~~Etc~~ Copper sent
to Extra nothing Extra

20 grammes Nitrate Rhodia
first class

40 grammes, Citric acid
Not very good

20 grammes Sulphate of Soda
First Class equal (about) to
any —

20 grammes Carb Soda
First Class —
W. add 500 always now after taking it on about Ckt

1 gramme Arsenate Quinine
on Ckt Weak = 500 al[illegible] R can just perceive of

1 gram [illegible] Arsenate Quinine
Sckt Weak = don't hear on 500

5 grammes Arsenite Soda
in first closing Ckt strong
then grows rather weak
not good on 500 nothing

33

1 gram Valeriana Soda
Weak

150 Mg. Hippuric Acid —
Nothing

1 gram Valeriana Magnesia
Very faint on shtckt =
gram reads a foot away, on
500 ohm [illegible] nothing

5 gram [illegible] Bromide Sodium
first class = gram reads at
more distant than above on
500, & think I can just hear it

5 grams Arsenate Soda
pretty faint = Exceedingly faint
on 500 gram just hears it

34

1 gram Caffein —
Nothing at all

1 gram Carbonate of Lithia
~~Fair~~ good = nothing Extra,
Gin just mean it on 500.

1 gram Carbozatic Acid —
~~Good at first~~ but poor =
gave [illegible] at the regular
dose [illegible] (1c) 1 front [illegible]
500

1 gram Iodide Quinine ~~=~~
Weak —

1 gram Sul Cobalt
Nothing good =
nothing on 500 also gin

35

1 gramme Acetate Solution
Very Weak

Endorsed Note Book
No 2

June 12 1897
Edison & Adams

36

Memo Relative to

EXPERIMENTAL

NOTES

No

Relative to Nouchen and
in decomposing Cell in
Passaic Creek —
Jany 12 1877

1 gramme Tartarate Magnesia =

Very weak = 500 ohms = adams hear it ~~close to bottle~~

1 gramme Cyanide Mercury =

Very weak on short ~~clit~~ = 400 ohms adams cant hardly hear it on long close to bottle.

1 gramme Acetate aluminum =

Weak on short = nothing on 400.

5 grammes Manganate Soda —

Fair = 400 ohms Adams Scarcely hear it =

1 gramme Acetate Morphia -

Nothing =

1 gramme Hypophosphate Manganese —

Very weak = 400 adams hears nothing

1 grm- Chloride Copper —

Weak in short - nothing on 400.

5 grammes Lactate Zinc -

Not very loud but gave low vibration about 10 to second = like frying lard in pan = adams can just read at 400 ohms

5 grammes Formate Soda —

good = fan at 400 ohms —

5 Grammes Sulphate Cadmium

1st touch key first class = died away = cause - deposition of Cadmium

nothing on 400 —

40 grammes Ferricyanide Potassium
First class - loud = 400 ohms cant
hear it =

1 gramme phosphate Potash.
First class not so strong as above -
= 400 ohms adams just hears it =

5 grammes Tungstate Soda -
First class - louder than Ferrid =
400. fair —

5 grammes Chloride Nickel.
Loud ~~at~~ first dies away

2 grammes Binoxalate Potash
Good = 400 just hear it

1 gramme phosphate Soda —
good = 400 ohms mercury dont hear

5 grammes Acetate of Baryta =
Not very good = 400 ohms adams
foot away hears it quite

5 grammes Citrate ammonia —
Slightly first Class = 400 Ohms very
faint indeed =

3 grammes Oxalate Soda —
First Class — 400, Ohms. Scarcely hear it

5 grms Bi-chromate Ammonia.
Nearly first Class = 400 ohms
Adams just hears it —

5 grammes Citrate Potash =

Strictly first-class = 400 ohms Adams

Cant hear it =

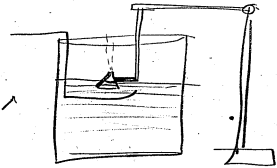
5 grms Nitrate Magnesia =

Weak = 400 ohms just hears it =

5 grammes Tartrate Potash =

Nearly 1st Class = 400 ohms Nothing

Try this



All insulated except inside of funnell & orifice which must be very small =

1 gramme Creosote =
Nothing

---

5 grammes Stannate Soda —
First Class = 400 ohms Adams hears it
Plain =

---

5 grammes Manganate Potash
First Class = 400 ohms - Hear it very plain

---

1 gramme Tungstate Ammonia:
Weak = 400 ohms, good Hear it on 2000
Ohms

---

1 gramme Valerianate Zinc.
No good = on 700 he hears it. also
just hear it through 1000 = probably
resistance of Sol so high addition
of the R dont make much difference
I think the lighter the spec gravity of the

fluid the greater the noise =

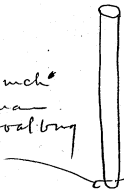
20 grammes Chloride Lithia
Weak = 400 hardly hear —

1 gramme Picrate Ammonia =
Fair = 400 ohms can hear it plain
through 1000 ohms better than lithia
Ammonia = it ~~more~~ d more
distinct =

5 grammes Hydro-Bromate Ammonia
fair to good = 400 ohms very faint

Tried about 1 inch of solution
in Cell covered with $2\frac{1}{2}$
inches Ether immersed
Electrodes in decomp solution
no difference (1.) nothing favorably

Took along tube



with platina decomposing points sealed in end = used 20 gram solution Potassic Hydrate = but it took at least 5 seconds before heard a noise then

it sounded like the frying of grease it took 5 or 6 seconds to stop after key closed = Oxygen was put in tube in bottom = then Hydrogen was put in tube with bare platina in bottom = put old covered wire + platina loop in no bottom poured it out in little cell + tested in usual way — splendid loud then shows that much depends upon size of cell amount of

fluid + disposition of the Electrodes =

By using the long tube + putting both Electrodes in the top OK = by putting the Oxygen Electrode down to bottom of tube. Bad - same phenomena as described on other page =

Jany 13th 1877

5 Gram
Phosphate Manganese
Very good on short Ckt — can just hear it —
1000 ohms closed bottle

5 Gram
Monochlor Acetic Acid
Weak cant hear anything 400 ohms

5 Gram Sulphate Vinum
Weak on short nothing on 400 ohms

1 Gram
Acetate Strychnine
Nothing on short ditto 400

1 Gram
Lacto Phosphate Bismuth
nothing on short — ditto 400 ohms

5 Grams
Phosphate Ammonia & Soda
When Electrodes is at the bottom takes long time to die away bring Earthen Electrode to the top. Clear and sharp but not very loud hear it on 400.

1 Gram
Per Chlorate Potash
good on Short weak on 4000 ohms
20 Grams
Grape Sugar
Can hardley hear it on Short Nothing 4000

5 Grams
Iodide Zinc
Nothing

1 Gram
~~Lact~~ Lactate Quinine Nothing

1 Gram
Chloride Propylamine
Weak Can only hear it

1 Gram
Sulphate Strychnine
Nothing

1 gram
Hyposulphate Barium
Only hear it close to bottle

47

1 Gram
Iodide Arsenic
Weak on short nothing on 400

1 Gram
Chloride Urinium
Weak on short nothing on 400

20 Grammes
Iodide Ammonia
Fair on short ckt nothing 400

1 Gram
Iodic Acid
Fair on short nothing on 400

1 Gram
Sulphate Cinchonidin
Nothing on short ditto 400

1 Gram
Lunar Caustic
Nothing slight decomposition from the oxigen bottle only

1 Gram
Saponin
Nothing Short ditto 400

1 Gram
Nitrate Strychnine
Nothing on Short Nothing 400

5 Gram
Chime Acid
Nothing on Short ditto 400

1 Gram
Pepsin
only head it on Short nothing 400

5 Grams
Nitrate Urinum
Very weak Nothing on 400

18 Grams
Valerianate of Potash
Very good on Short Nothing 400

20 Grams
Uric acid Nothing ditto 400

8 Grams
Oxalate Potash
Very Weak Nothing 400 ohms

8 Grams
Iodide Sodium
fair on Short just hear it - 400

1 Gram
Lactate Iron
Nothing on Short - Nothing 400

5 grams
Acetate Zinc
Cant hear anything bubbles dont break
off from the organ pole unless the key is
opened when it does very quick but if the
key is kept closed for a short time
it will go of slowly

3 Grams
Gallate Ammonia
Nothing on short ditto on 4.00

1 Gramme
Chloride Morphia
Very Weak on short ditto 4.00

20 Grammes
Ammonia Citrate 9 ozs
Mix

1 Gramme
Arsenate Ammonia
Very Weak

3 Grams
Chromate Potash
Very Weak

1 Gramme
Borate Copper
Nothing on short Northup 4.00

1 Grame
Citrate Magnesia
Only heard it

51

1 Gram
Tartarate Magnesia
Very Weak on Short nothing on L400

5 Grams
Bi Sulphate Soda
fair take some time for ~~[illegible]~~
to die away after opening

5 Grams
Chlorate Soda
Not very good Nothing on L400

1 Gramme
Sulphate Anilin
head Nothing on Short ditto L400

5 Grams
Acetate Lime
can only hear it on Short

1 Gram
Phosphate Lime
Nothing on Short ditto L400

5 Gramme
Acetate Magnesia
Very good on short can only hear it
1 foot away on 400 ohms

1 Gramme
Protochloride of Tin
Can only hear it close to Bottle

20 Grammes
Per Manganate Sodium
hear it plain one foot away
takes some time to come out after opening

5 Grammes
Acetate Cobalt
Can only hear it close to Bottle

5 Gram
Iodide Barium
Very good on short can hear it close
to Bottle on 400 ohms

20 Grammes
Protochloride of Iron
Can only hear it close to bottle on short circ.

5 Grammes

Hyposulphate Ammonia

Very Good on Short-Cut — can Hardly hear it on 400 ohms

---

1 Gram

Valerianate ~~Ammonia~~ Morphine

Nothing on Short Cut — ditto on 400

---

5 Grammes

Mannite

Nothing

---

1 Gramme

Salicylic Acid

Very Weak

---

1 Gram

Asparagin

Very good on Short-Cut —

Can hear it Close to Bottle on 400

---

1 Gram

Glycocoll

takes a long time to Clear itself from Carbon Bile

Common effects of Strychnine

Sarcolactate very good

20 Gram

Chloride Zinc

Nothing on Short ditto on 400

5 Gram

~~Antin~~ Anti Arsenate Potash

Very good on Short Cat-can hear it-cl

to Bottle on 400 ohms

1 Gram

Sulphate Bebarin

Nothing on Short ditto on 400

5 Grams

Chloride Magnesium

Can only hear it close to Bottle

1 Gram

Sulphate Calcium

Can only hear it close to Bottle

10 Gram

Phosphe Wolframic Acid

very Weak

55

5 grammes Lactic Acid.

Fair = Can't hear on 400

20 grammes Chloral Hydrate.

Nothing at all = fine bubbles on H large on O = apparently more gas from O than H =

1 gramme Phosphate Magnesia

Can't hear it. Jim says he can ~~it~~ very poor = yet there appears to be plenty gas given off O =

5 grams Iodide Cadmium

Nothing whatever = apparently Iodine on Oxygen Electrode & Cadmium on Hydrogen

56

20 grammes Nitrate Lime =
Just Class = Hear it plain
though 400 ohm with Ear to
bottle mouth =

1 gram Chloroform.
Nothing = High R probably

20 grammes Sulphate Copper
~~Nitrate~~ Extra first Class

The Sound is different from
any Solution yet tried = its
Sound, like drawing a
room pad lengthwise on a
wire to make longitudinal
Vibrations. After closing for 1/2
minute the Sound gradually
dies away & then has plain
gas noise not loud over

57

It is probably due to deposition of Copper for if I take out wire & rub off deposited Copper I get the same kind of noise again = when the deposit of Copper is on I notice that the regular noise requires time to [illegible] to stop =

5 grammes Gum Dextrin.

PHENOMENON

First Class : on short ckt the noise which is loud is made up of that sharp explosions occurring about 6 or 8 per second on 500 ohms these explosions are nearly as loud but qwe 2 to the second on 1000 ohm 1 per second

on 2000 1 every 2 seconds

4000 ohms 1 every 4 seconds.
~~The noise~~ 400 on = on 10000
the noise of the explosion is
undiminished, and we could
probably get through any
Resistance but the noise would
be further apart = The Electrodes
were on P. platina wire on H
No 2 office were Carbon Cones
with platina loop on end =
perhaps if it were moulded
all the way to the platina loop
it would give better results —
The reason further investigation
By varying the Electrode it
got the explosions so close together
that they sound nearly like
the regular noise, in short.
Circuit they are better than
anything yet to read by

are very plain in 1000
impact this is the only satisfactory
solution that I have seen yet
that I could read in 1000
I having so. heard = to very
plain on 1000 but the
explosions are about 1 per
second hence could not be
used for signalling =

5 Grammes Gum Tragacanth =
Don't give hardly any noise =
But Phenomenon on the Oxygen
Electrode there is deposited
a Graceful layer to tragacanth
which is due to the gas =

5 grammes Oxalate Ammonia
Extra first Class I heat it
8 minutes off. on 1000 ohm
got Explosions 1. seemed apart
+ like Dextrin = but not so
strong =

20 grammes Sesquichloride of
Iron =
Good at first not good
afterwards =

20 grams Pyrolignos acid
Not very good = get the Explosion
but good though 1000 ohm
over in 2 seconds

61

20 grammes Tartaric Acid.
Not good here it though on that
circuit =

---

5 grams Venice Turpentine + 1 Gram
Caustic Potash =
Not good = Phenomen =
on the Oxygen Electrode there
is deposited a Coating of
Resin or wax which can be
peeled off as cuticle what
this =

---

5 grammes Sulphuret Calcium
Good nearly 1st class
~~[illegible]~~ 2 days Can just here on
400

62

1 gram Caustic Potash
5 grams Gamboge
Not good = forms
Layer of gummy stuff in
O. Electrode & white stuff
on N.

5 grams Gum Guaiacum
No good

20 gram Sulphuret Antimony
No good = gas bubbles on
Short circ't

5 grms Nitrate Lead
No good = deposits on N

1 grm Caustic Soda 5 grms
Gumboogie =
Good at first bad afterwards

5 grams Gum Guaiacum
5 grms Caustic Potash
Good at first) nature good
afterwards

40 grms Caustic Soda
Very good probably
Was first class appears to
be an enormous decomposition
of fuchsin grms without
a proportionate amount
of noise =

5 grammes Caustic Potash
5 gram Gum Tulu —
First class on closing - then
goes to nothing

5 grms Gum Senegal
1 gram Caustic Potash
Nothing good

5 grms Gum Benzoin
1 gram Caustic Potash
fair

1 gram Gum Incense
Nothing probably on
account high resistance

1 gm Balsam Tulu
No good

40 gms Glycerin
Just fair

2 grams Gamboge
Nothing

5 gms Gum Myrrh
1 Caustic Potash
No good — Beautiful
Experiment for Lantern
on O pale the rise solid
Cones one filling in the
other, most beautiful sight
by it

1 gram Caustic Kali.
4 gm Sandarach
good = gum dissolved in O, Alcohol

5 grammi Balsam Peru
1 Caustic Kali —
Not very good

4 grms Balsam Canada
2 grams Caustic Potash
Not very good. while deposit on O sticks with great tenacity

5 gm Tragacanth
1 Caustic Potash
No good

67

1 gram Butrate Palash
Not good

1 gram Tulu
5 " Canada Palash
First Class

5 grms Balsam Peru
5 grm Canada Palash
good to first class
nothing on 400

1 gram Benzoic Acid
No good = probably on
account of high Physical

68

5 grams Balsam Copaiba
1 gram Caustic Soda
Nothing

This finishes the
Water Solution

Jan 13 1896

69

Merlo Laboratory

Experimental Notes

No 3

[illegible]
heard in the decomposition
Cell in the passage of
an the Current
Paris 1 18[illegible]
+ [illegible] Mercury
under Electrolysis

7 pm Saturday 13th 1867

We now having exhausted our water solutions take up the alcohol series

Wells Carbon bodies

~~[illegible]~~

Alcohol - Nitrate Uranium
~~Hg~~ Nothing heard - slight amount
gas from Ethereal =

Alcohol Acetate Mercury
Nothing
no other gas

Oil Rosemary & Pulegium
nothing

Alcohol & Gum le Palissy
Nothing cannot
gas in Ethereal

72

Alcohol & Alcohol Triplicate
Nothing [illegible] (1) [illegible]
[illegible] around [illegible] Church

Alcohol Dyspepsia & [illegible]
Nothing

Alcohol = Bogus Carbolic Palate
[illegible] Hand of little [illegible]

Carbolic Pa Cash Oil Rosemary

[illegible] Zinc -
Nothing

[illegible] Iron
Nothing good

73

Alcohol & Bromide Cadmium
Nothing

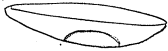
Nothing

Spirits Turpentine & Chloroform
Nothing

We conclude that the
the
highest in the Solution
We are now going into experiments
with 1 & 2 & 3 & 4 with different
Shapes of Electrodes Jars &c
&c

74

Experiments with globule of mercury placed in flat dish covered with different solution = 2 Cells, Carbon Battery platina Electrodes think



Mercury not very pure

I believe that friction of surface keeps the mercury globular & that if globule forms ~~[illegible]~~ the Zinc pole hydrogen is set free and this acts to [illegible] like the EMq the [illegible] it spreads out = [illegible] if it from the [illegible] oxidized ~~[illegible]~~ to be mercury so to spread

an alloy of an oxide & mercury
hence lessening of the globule &
flattening out = after its been
flattened it may be brought to
globule state by causing it
to be the Zinc pole = the H
reducing The oxide = 9 nature
that when it is the Zinc pole
the globule moves freely
on bottom of dish but if
the O pole it shrinks somewhat
doesnt have free movement

20 grammes Tantalic Soda - 100 c.c.
Platina Electrode
Mercury draws out when connected to
Zinc pole =
~~with~~ all Metals act as
in drawing it out
~~Fe~~ Aluminum
Zinc Copper -
platinum -

How speedily not a sign of affinity
with Mercury to Oxygen =

20 grammes Sulphate Zinc =

Hg = remains beautiful rounded
when both poles are only dipped
in solution and touching Hg
the film moves = with either pole
in Hg. it is not attracted (18)
does not tend to reach out towards
the pole - like the Tartrate =
film moves which Cop or Zinc
in in Hg = that with Platina
Electrode = with platina to Hg
Slight affinity to
aluminum Move so towards

Tin - do Copper = Lead do Brass
not so much in Zinc
Very little movement
Carbon to Hg

10 grains Tannic Acid
when Hg Commenced to Zinc of
Gally all metals attracted,
nothing seen when Hg
to Carbon = Nothing Naturally
[illegible] aluminum

---

20 grammes Commercial alumi
Hg to Zinc, [illegible] duces drawing
out & attraction with all the
metals except platina & aluminum,
none on platina - yes after what I notice
large gas bubbles under Hg
which raise it up and in its
Effort to Escape keeps the
Hg in Violent Motion =

o Electrod

1/4 inch attraction

nothing seen when Carbon to Hg =

1 gramme Bichromic Acid spreads at first class, when Hg to Carbon it sticks well to dish but to Zinc its moving about by moving Electrode showing liquefying in friction = it flattens when connected to Oxygen & globulate when connected to Hydrogen =

1 gramme Citrate Palad, Excessively Mobile = either towards all metals no oxide formed

20 grammes Caustic Potash

Phenomena

With Oxygen on Hg. it rapidly oxidized and spreds out flat over a surface several times the size of the globule & is coated with a beautiful film which in time became black ~~if left~~ if now Hydrogen Gas is passed to Hg the Oxide is reduced ~~& the~~ it assumes globular shape almost immediately & became clean — Beautiful Experiment this

dont spread when Hg is connected to Oxy[illegible] with an aluminum El[illegible] spreads quick with Hy[illegible]

very little with Carbon lead &
Zinc nothing good Copper
good = (Notice that there is not violent agitation
where oxygen & the Hg which the oxide is being
reduced by H but rather it is than for an
instant there is a vacuum current =)

Lograsmus Jade de Palomon

Phenomenal Galvanism

1st Connect Hg with H then
with O. beautiful mirror
in top of globule which
stays for 10 or 15 seconds =
= There is a fearful agitation
of the mercury when one
pole then the other is
connected to it then but
connected together =

I notice that the Current
or gulf stream circulation
proceeds from the O pole
towards the Hg with pole

I prove it by connecting Zal with strips of paper which is on table & touch H. pole to this = ~~to~~ Has an actually after Electrode disconnected via phenomenal

---

20 grammes Hyposulphate Soda. Not very phenomenal spreads very slightly when ~~Hg~~ O to Hg.

---

20 grammes Ferrocyanide Potassium Very Mobile dont spread out flat but very little. When Hg connected to O, opalescent oxide collects, which is instantly reduced by H.

Gum Dextrin Salycilic Acid
+ Lith. Salt nothing
phenomenal

40 grammes Citric Acid
nothing phenomenal -
doesnt spread out in the
least on Eulk

~~Also 4, 18 grm~~ same Hg as above alloyed with

40 grammes Nitrate Ammonia
Not very good =
amalgamated Hg in platinum electrode
connected to
makes a precipitate which clouds
sol so can see =

84

20 grammes Carb Soda
Very Mobile attracted
touched with O Electrode
instantly squats & sticks
to dish touched with H
Electrode instantly assume
globular form & is mobile -

Fresh Aq
20 grams Sulphate Soda
Exceedingly Mobile

Phenomenum when Aq Connected
to O pole it assumes a
more globular form (ie) contracts
& gets higher coherence if it
is connected to H it spends
out but very little not more
than its normal globularity -
when it assumes a more globular
form it sticks to dish - it retains
the form of even Current open & it

is pressed down with fingers
but moment H pole is removed
it instantly assumes its
normal condition:
Great agitation of H pole
is in liquid & O. pole
held in liquid just over
Mercury

---

20 grams Bi carb Potash
Very Mobile Phenomenal
O, ~~H~~ connected to Hg - it
spreads out flat slowly & in
curious shapes; but instantly
assumes normal condition by
opening circuit = I notice
that if O being connected to
Hg for some time that H
can be put in it

then connecting Gath
pole to Hg when there will
be an energetic circulation
of gas or something over
surface of Hg. between two
poles which causes in few
seconds apparently Hg.
absorbed something =

---

40 grammes Sulphate Magnesia
Excessively mobile
reaches out for ⊖ Electricity
1/2 inch = Very Violent
Current =

---

40 grammes Nitrate Strontia

Not good = hardly moves; apparently absorbs something which Hg combines with.

---

8 grammes Borate Soda

Nothing very noticeable when Hg connected to O. it instantly sticks to Cup =

---

10 grammes Bichromate Potash =

Not good = apparently Hg. itself has no mobility in this solution = Scarcely attracted by O pole & when it is it must be close & then nearly whole globule spreads instead of a short out towards O pole = this may have some effect to do with polarization in a battery

88

40 grammes Bromide Potassium
when Connected to O,
Contracts instantly, assume
normal Condition when
touched with H.
or when O taken from it and
touch in Solution just about it

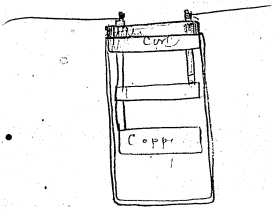
---

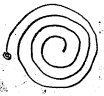
20 grammes Pyrogallic Acid
Poor

---

20 grammes gum Arabec
no good
Good Idea to get a lot
of Hydrogen gas
Use a syrupy liquid with
Electrodes the Hydrogen
gas bubbles. Cant get up
freely never Enormous amount of
pretty Stuff which will be 1/2 or more
pure hydrogen

Interesting Note



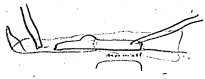


89

8 grammes Bicarb Soda –
Mabel = spread out
slowly with Hg to O,
& not very far instantly
restored by Hg to A.

---

20 grammes phosphate Ammonia
Mabel = When Hg Crunched
to A pale fearful undertow Current
from O draws out Hg &
a gas bubble (9 knuckle) raises up
Hg about twice a second then



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20 grammes Nitrate Potash
When O to Hg. oxidized quickly 1st
black oxide then a brown volatile
floating oxide which gets re-
duced & forms a shell which
breaks off from Hg when electrode
with tar & stays in solution
by oxidizing surface slightly
& then deoxidizing with Hg
beautiful think crystal or
flakes of the substance can be
made quickly they are indiscreet

---

20 grammes Bromide Ammonium
with O to Hg beautiful
indiscreet oxidation =
peels off = when first
connect Hg to O. it trembles
and takes several seconds
before oxidation commences

8 grammes Chlorate Potash
& Acetic Acid Mobile
Not very phenomenal =

5 grams Chloride Nickel
very little movement = a little
fugitive oxidation

40 grammes Ferrocyanide Potash
Not good Dont move =
= apparently Hg to Hg
gets an oxide (10) & mean a
Coating =

10 grammes formate Copper
Nothing whatever

20 grammes phosphate Potash
Very Mobile - spreads out
very slightly when Hg to
O =

---

5 grammes Tungstate Soda

Cadmium Sulphate 20 grammes
= No good - no movement
Hg with O to H point
after which Cadmium deposited
in H.

---

2 grames Binoxalate Potash
No good

Loadale Zwie

Formate Soda.

Phenomenon

When Hg ~~was~~ has been connected to Hydrogen for 1/2 minute or so & then its connected to O, a most violent agitation takes place in Hg which towards the last boils & splashes about in a most zealous manner & then suddenly be quiet & stays so until it is again allowed to be hydrogenized & find that after it has stopped that the most infinite hydrogenizing only a fraction of a second it same violent boiling takes place & keeps it up just as long as if I have Hg connected to H for 1/2 minute

Curious

5 grams Trichromate ammonia -
Phenomena =
Connecting Hg to O. Short
from the mercury can be
made to follow the H pole
all around the cup

5 grammes Acetate Baryta -
Very Mobile --

5 grams Tartrate Potash
Exceedingly Mobile
water between when H + O
Electrodes are placed in
beyond Each side of Hg
it draws out lengthens
1/4 to 1/2 inch

5 grams Nitrate Magnesia
Nonqvod

5 grams Citrate Potash.

Very mobile & after being
thoroughly oxidized the more
lowish of the H Elements
apparently deoxidizes it &
they if H be kept in solution
most violent boiling & Calorific
takes place until it comes to
Octal of rest

5 grm Citrate ammonia.
Very Mobile qvod =
dont know the above phenom
Gas Cit Pot = funny work it

Wednesday 16 1877 =
I am J M Edwards
79 Wm Adams

96

Jany 17, 1897

We now resume our experiment on the movement of globules of mercury under Electrolysis in Solutions of Various Substances 8 PM =

100 Mg. Citrate Quinine =

Note When I gave Zinc Electrode & mean Carbon & un changed connections unknown to me

~~Previously I had a round platina~~ wire 1/16 diam to form the Electrode Connected to the Zinc pole but having to use this I substituted a flat sheet same as that connected to Carbon pole which is about 3/16 wide & I find that with the above Solution (& will probably find with others same I have a fine point) that if point of Zinc Electrode be brought in Contact with Hg + then just withdrawn it will vibrate automatically like the beat of an indication Coil

& the Carbon Electrode Unit from Dry Battery

the Hg being attracted (B) spread out
until it connects with the 2nd
Electrode when it contracts etc =
Jim hears / the noise of the
spark = this would poby be
nice with large battery =
No other phenomena

1 gramme Valuianate Soda
I find that after platina
point of plate has became
amalgamated I no longer
get self make & break this
accounts for reason why I
did not get it last night
both Electrodes where amalgamated
whereas tonight a fresh Electrode
was put in connection =
I think Carbon would replace the
platina = I find that Carbon of
a lead pencil does but the
vibration + spark is small poby
due to high resistance of lead

the Hg is ~~n~~ Very mobile -
moves from H to O freely 3/8 in d.

5 grammes Valerianate Ammonia (By oxalate)
Hg dont spread on ~~Ether~~ but
is at times as quite mobile =
forms Mercurio = H dont apparently
deoxidize + clean globule of Cinn

1 Gram Arsenate of Quinine
Mobile | Mobile =

20 grams Phosphate Soda -
1st I notice after H is connected to
Hg that its hard to get O Electrode
to connect to Hg ~~appear~~ but
after time it connects -
2nd if Hg is thoroughly oxidized
& is touched only for instant
with H. which O Electrode is still
connected it assume mobility &
if H Electrode be put in [illegible]
a fearful agitation of Hg [illegible]

which continues for 10 or 15 seconds.
a mirror forms which gradually
grows smaller & dies out when
surface is thoroughly oxidized.

20 grams Bi Sulphate P. alcohol
1st nothing very noticeable = Hg to H
forcing covered with bubbles, Hydrogen.

150 gm. Hippuric Acid =
Nothing noticeable =

1 gramme Caffeine -
nothing much

1 gramme Acetate Silver -
surface of Hg becomes instantly
black = no movement whatever of Hg

20 grammes Bromide Sodium
when both Electrodes are in
liquid & Hg between very mobile but
when connected to H it doesn't spread
but very little = when connected
to O, it oxidates with beautiful
Mirror which very gradually grows
smaller & in the mirror may be seen
particles of oxide passing in all directions
with the rapidity of lightning

---

5 grammes Arsenite Soda
Very Phenomenal Mercury in
this Solution loses all mobility
without any Electrolysis whatever

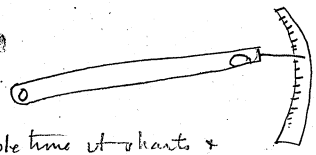
Laboratory Notes

when H is in Hg & O Electrode
held over mercury most beautiful
oxydation takes place iridescent
Colors red violet green = it cannot
be deoxidized by H = if the solution
is poured off & other solution poured
in Hg mercury assumes its mobility

This is the Only Chemical
so far that makes Hg loose its mobility
without any Electrolysis =

1 gramme Valerianate of Magnesia
rather mobile · no phenomena.

1 gramme Sulphate Cobalt (short stem)
& notice that (before allowing Electrode)
Hg is very mobile & globular in this!
= note perhaps Each Solution causes
Hg to be more or less mobile this
Could be tested thus



note time it shorts &
time it takes to reach Bottom when
Contact not well just run =

1 gram Carbonate Lithia.

Exceedingly mobile & attracted by O when Hg connected to H Electrode - loses power somewhat when ~~as~~ oxidized ~~of~~ & found that when it is allowing to oxidize a white fluccolent oxide forms on dipt & rises to top = it merely made mobile by touch of H wire when effected put in solution violent agitation continued until Hg is drawn up to a globule & is stuck to dish = no mention is made of oxidizing =

---

1 gram Carbazotic Acid =
When H is connected to Hg I found that Hg recedes from O pole = it becomes by Hydrogen semi solid without mobility.
I found by using fresh solution that Hg loses its mobility greatly without Electrolysis =

20 grammes Manganate Soda =
oxidate with very tough skin
which is gradually deoxides by
H to Hg = nothing very noticeable

1 gramme Cyanide Mercury
Nothing

1 gram Tartrate Manganese
Nothing.

1 gram Iodide Quinine =
without Electrolysis - it is not just clear mobile
though definitely moveable = with Electrolysis
not very mobile -

5 grammes Arsenate Soda -
without Electrode = Exceedingly Mobile
This is just opposite Arsenite Soda
With Electrode Hg to O. oxidat to more
globular form. Slix = H deoxidat to more mobile

200 M.g. Sulphate Quinin =
not mobile to any great extent = with Electrodes
nothing noticeable =

---

1 gramme Acetate Alumina
Mobile = with Electrodes Nothing much

---

5 grms Amygdaline =
not very mobile poly on account with Electrodes
high resistance

---

1 grm Nitro-prusside Sodium (Usually decomp Blue)
only noticeable thing is that can't
get O Electrode to amalgamate or
connect Metallically with the Hg =

---

14 grms Acetate Uranium —
Nothing = Something is wrong
with my O Electrode dont
amalgamate so as to connect to Hg
although it may be the st, + the
above solution =

105

1 gram Citrate Caffeine =
no X

1 gramme Chloride Copper
blackened = no movement

1 gramme Aloin
no X

1 gramme Tannate Iron
no X

1 gram Valerianate Quinine
no X

1 gm Acetate Morphia
no X

1 gramme Cyanide Silver
no X

106

5 grammes Hypophosphite Manganese

Mix Dry Mobile without Electricity.

20 grms Sulphate Indigo.

Mix

Go for a bath book

107

107

Experiments to determine the relative capillary force shown by the following oils.

Jan 14th 1877 Scale used attached. Small tube bottomed & scale touching bottom

Time 1.47 PM

Oil of	minutes 15	30	60	120	240	1130 am	1 PM	2 PM 7.30	10	Remarks
Lemon grass	½	4	9	14	20¼	26	34½	36	36	36	done
Juniper berry	2½	6½	6	7	7	7	7½	8	8	8	done
Spruce	0	3	6½	10	13	16½	23½	24	24	26½	
Citronella	-2	0	2½	5½	10		21½	25	30	32	
Cade	-4	-3	-2	0	3	5	9½	11	14½	13½	done
Cubebs	-3	-2	0	2	5	8	12½	14	16	17	
Carui	3	5¼	10	12	15	19	24	25½	26	26	done
Orange	6½	11¼	14¾	15	14	15	14½	15	15	10	done
Cloves	-2½	-1½	2½	6	12	19	32	15½	43	45½	
Peppermint	-2	0	4¾	5	8	9	10½	11	11	11½	done
Lemon	5	9½	13½	14½	15	16	14½	15	15	9½	done
Juniper wood	2	5	7½	9	10½	12	13½	14	14	14	done
Tansy	2	5½	8	9	9½		10	10	10	10	done
Fennel	5	9	16	20½	24		42	43	43	43	done
Sassafras	2	6	13½	20½	30	37	55½	57	60	60	done
Spearmint	3	7	14	19	25½	31	43	43	44	44	done
Wormseed	2	5½	10	14	19	23	30	30	31	31	done
Lavender flow	0	2	6	9½	14	16½	21	22	22	22	done
Succina	3	6	10½	15	22	28	40	44	50	52	
Pennyroyal	0	3	7½	11½	14	15	15½	16	16	16	done
White thyme	3½	5½	8½	10	13	16	21½	23	24½	26½	
Croton	-5	-5	-3½	-2½	0		7	9	13	15½	
Wintergreen	1	5	11	17	24	28	36	36	39	39	done
Bergamot	2½	5½	10	13½	16½	18	18	18	18	26	
Jasmine	0	½	1½	1	2	4	4	5	7	8	
Sperm	-3	-2½	0	2½	7	11½	22	27	35	39	
Cajeput	0	2½	6	8	11	14	20	21½	24	25	
Origanum	3	4½	6	8	9	10½	12½	13½	14	14½	
Thyme											

108

January 14 1877 — 15th

Times	PM 15 minutes	30	1 hour 60 shown		4 hours		1130 or PM 730	Remarks
Kerosene 1.58 PM	3½	6¼	11	17¼	25½	34	55	64 – the top
Alcohol PM 2.04	½	1	1	1	1	1	1	Alcohol No 2 Sealed in
						25		test tube
Alcohol No 3 4.07								to top
do 6 PM								16

Remarks.

On Friday 3rd 1876 They stood.

Sperm oil	full up	most of it	scarcely any of any from bottle gone,
Kerosene	full gone	= 1/5 gone	
Oil organum	15	3/5 gone	
Lemon grass	36	1/8 gone	
Cedar	14	Contents	
Juniper berries	8	1/2 gone	
Cubeb spirits	18	1/2 gone	gone
Carm.	26	3/4 gone	
Clove	55	1/8 gone	
Almatic	48½	1/10 gone	
Orange	15	1/2 gone	
Lemon	15	1/3 gone	
Peppermint	11	none gone	
Thyme	10	3/4 gone	
Pimento	62	1/2 gone top broken	colour yellow
Fennel	42	all gone	
Clove	31	1/3 gone	in bottle
Spearmint	44	1/2 gone	
Lavender	22	scarcely any gone	
Thyme	27	3/4 gone	
oil Cocoa	60	3/4 or more gone	
Pimento	16	1/4 gone	bottle perfectly dry top broken 38 Stocken
wintergreen	38	1/2 contents	
Cubeb	38	1/2 gone	
fennel	14	bottle dry	
Bergamot	18	1/8 gone	
Cajeput	28	3/5 gone	

109

Phenomenon.

If a piece of paper be dipped in a dilute solution of Sulphuric Acid in a bottle, and the strip say half of it be left hanging out, it will in time by Capillary attraction become wet and if detached will in time be found to be perfectly dissolved squeezing it in the hands turns it into a stiff jelly like lump = whereas the paper in the acid solution is not attacked = this is probably due to concentration of the acid by the evaporation of the water - and it opens a way to make Nitro-Cellulose for Celluloid by mixing the 3 NO_5 & 9 SO_3 & immersing ~~[illegible]~~ portions of hundreds of sheets in liquid which will run up on the sheets by Capillary attraction and thus will be a slow action thus preserving the paper and keeping the acids concentrated by evaporation of the water = February 3 1877.

T A Edison

Zinc Chloride in Solution acts same way: the water evaporating & concentrating Chl Zinc the effect is nil on the paper immersed in bottle = The paper outside of bottle is semi transparent & has swelled 3 or 4 times its thickness & contracted in width - no salient action as I can see

Stannous Chl same phenomenon, but paper coloured brownish & semi transparent & not extreme and accompanied a drop (opened out) of thick oily stuff =

110

Hydrochloric acid dilute acts precisely same as SO_3 =

Nitric acid [illegible] don't appear to Capillarize =

Sulphurous acid same as SO_3 =

Rectified Oil ambr: flop on outside bottle by Evaporation deposits thick gummy stuff. very Clear & transparent yellow color & like Canada balsam

Another Solvent for Paper

[illegible] strip of paper left in Oil of Thyme white for 10 days, semi dissolves. you can [illegible]ndly pull it out of bottle & if [illegible]ced between fingers is fully [illegible] oil as hard or butter =

[illegible]ther Experiment. put some tissue in [illegible] by 3rd. 1877 =

Another Solvent for Paper

(gets thick) juniper wood, or [illegible] (gets thick) "as stiff as wax" "but [illegible] very thick in oil"

Juniper [illegible] = semi you can strip into a dough think it [illegible] as Thymol = put [illegible]

111

mary 111/8

try it closer
nothing yes good
c
where is all
where is all
it-come good
put-ion cld ata

Another & the best solvent for paper

Oil Lemon - Clear dissolve - In small bottle
& put loose in - Feby 3/77. I notice other no effect

I notice that acid oil thyme dont dissolve paper =

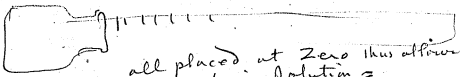
Very strange to say neither Oil of Lemon or Juniper berries dissolve the paper in the large bottle - but Oil Whole Thyme does even better than in smaller bottle = The Lemon bottle is blue glass, & has neither had as much heat or light as the smaller bottle = I think there has been a mistake

in labelling smaller bottles
Juniper wood in larger
bottle semi dessolves while
Juniper berries does not have
I conclude the Juniper wood

Arsenic acid having a thick vessel
hyped on top crystals Dolfin
& smell paper = (good for writing for
autographic poly) but the dissolve
is not A.1. —

113

Capillary Experiment with Alcohol & water in different proportions, small bottle & auto paper scale.



all placed at Zero thus allowing 3/8 inch in solution =

No 1	8 1/2	most alcohol
No 2	10 1/2	less "
No 3	11	less
No 4	9	less
No 5	9 1/2	less

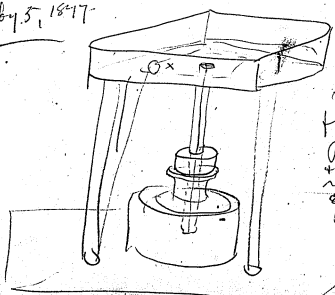
Unreliable. After 2 hours

With Capillary tube composed of a piece of Geo Little's glass capillary U Tube = Alcohol runs up a certain distance while H O a much greater distance & the distance is in proportion in which Al & H O are mixed & should think this would be a good thing for measuring percentages of Al & other liquids in H O

I find that with sesquichl Fe_2
Sul Zinc — ~~pa~~ manganate K;
in Capillary tube the Column
is not affected by magnetism
at all, possibly some liquids
might but doubtful.

I have an idea for Crystallization
that might be of some value
for some purposes this
Capillary bore of a tube rises liquid

Feby. 5, 1897.



from bottle on into
flat dish onto a
piece Bibulous paper
there being
rapid evaporation
Efflorescent Crystals
take place in
dish is full
I see this take
place in several
solutions with
paper strips.

We now attempt to make oil of white Thyme a more active & rapid solvent of Cellulose =

white paper & Mammilla Tissue =

Heat

Oil white Thyme - acetate Manganeous, 1 mix

my No	1.	Sesqui Chloride Fe.	O.W.T.	mix
"	2	Chloral Hydrate	"	mix.
"	3	Ether	"	mix
			"	mix
gmi.	No. 1.	Collodion	"	mix
Edwin	4	Creosote	"	mix -
"	5	Aqua ammonia	"	just touches it. =
"	6	Sulphate Iron crystal &	"	mix
"	7	Bromide K crystal &	"	mix
adam	No. 2.	Caustic Pot	"	mix
	3	acetic acid	"	Sulfuric.
Edwin	4	Benzol	"	mix
adam	4	Camphor	"	mix.
Edwin	9	Oil Mirbane	"	mix
"	10	Oil Mirbane & ammi oil &	"	mix =
Edwin	11	Oil Turpentine &	"	mix =
Edwin		Arsenious acid ~~Liquid~~ &	O.W.T.	mix
adam		Arsenic Acid. Liquid &	O.W.T.	dissolves it like a flash

but thinks to the Acid, as I noticed it dissolved strip this morning see 1st part of the book -

= Glycerine & O W Thyme mix.

12. Chl Calcium ~~&~~ & O W T mix

& aniline Oil & O W T mix

" acid & O W T mix

Edwin 13. Phosphate Lime. nitrate ammonia & O.W.T. mix

Gum - Sulphate Soda + OWT. mix

Edum Gelatin. + OWT. Swellings - consecution N.G.

" 14, Anilin oil. Sulphur O.W.T. Chloral Hydrate. Mix.

Adams, Natrali Cobaltcl + O.W.T. it appears to soften paper considerably but dont dissolve after heat is taken away becomes very hard = it is probable that if paper left for several days in OWT with little Natrali Cobaltcl Actual it will make a more perfect dissolve than with OWT Thymol alone = .

Edum 15 = OWT Thymol Benzoic Acid + Salicylic A. mix OWT. + Acetate of Mercury N.G.

Edum ~~16~~ gallic acid = mix

" 17. gallic acid Anilin Oil N.G.

" 18, Tannic acid aniline oil. Gum Arabic mix OWT + Solid Thymol. ~~mix~~

120

144/000
1,44,000

1200
1200
12400200
1200
1,240,200

117

Paper dissolved in arsenic acid, slimy - does not dry as the Arsenic Acid has such a powerful affinity for Water =

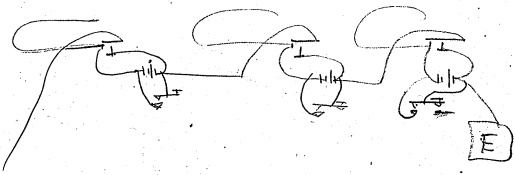
The Manganate of Soda & Permanganate of Potash 1 5 10 & 20 gram Solution in 100 cc H_2O all cause the paper slips immersed in them to become colored black & perfectly disintegrated so that the paper is hard & brittle & when dry crumbles to a black powder its insoluble in Amylic oil = alcohol & Camphor - H_2O, = Later all the Manganates & pam does it -

---

118

1/47
Feby. 6. put a long strip of
paper in Large Cochili Oil Thyme

119


E

Boston Boston. .30

These samples were taken by writing directly on the paper wetting it & using it as a stencil

Boston Feby 13 1879. T A Edison

Boston

Boston Boston Boston

Boston Boston Boston

Boston Boston Boston

Boston Boston Boston

Boston Boston

Boston Boston

Boston

Boston

Boston

Boston Boston

Boston Boston

c/
Edison what do you think if I make the rubber only half as thick

too far off

Talk lower

~~Not bad Have you got v.s.~~

~~9 ht Get now~~

time

Better g.a.

~~Not yet yes~~

Best yet

1 vc Feamer ~~[illegible]~~ hater

gor

the band
if frown to fthe rubber
and gum roberriakhram
wlldout the laseryou sent
came loud and utny seruac

I do it again

make band
to hog so it will
be fterable 9.a 9.a

~~9a~~

good lalk slow
~~reb~~ got Nothing
no the
No thing

noc no got nothing
not

124

Of it pleals Kown

No 4

20 grammes Manganate Potash
Oxidation forms strong stum &
Mercury loses all mobility & is
scarcely realised by Hydrogenizing.

20 grammes Hydro Bromate ammonia
Mercury which adheres to H electrode is
(the drop of)
by Hydrogen made to swell up
Enormously lose its mobility
like that spoken of in Chemical
works with Chloride ammonium
form an Hydrogen amalgam or
an Ammonium amalgam – it is
fearful Mobile with Electrode being attached ½ inch
by O.

5 Grams Granular Soda –
fearful Mobile when Electrode are
both in liquid Cat Hg it spreads
out ½ – about 3/16 when
on liquid + H in Hg –
it loses its power gradually (after
(been manipulated with) of spreading out but 2 Electrodes

1 gramme Ricati Ammonia
Loses all mobility without Electricity
probably from thick stiff
envelope of Oxide = (passivised)
by O to Hg =

---

20 grams Chloride Lithia -
when to O. oxidised with a Mirror
easily deoxidised by a touch of H.

---

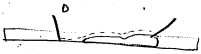
1 gm. Sulphate Cerium

Moderately mobile 1/16 advance towards
O. when H to Hg.

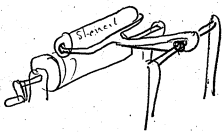
---

20 grams Iodide Calcium
Splendid when H to Hg
advance full 1/2 inch over to
O Electricity but does not
return with facility appears all
stay to bottom dish = it oxidat
but is spread by touch with H the work

20 grammes Acetate Strontia
Very Mobile between O & H +
with H in Hg - & towards O
dont apparently oxidate much
fearful Current from O towards
Hg with H in it ~~[illegible]~~ altho
form Hg Ions



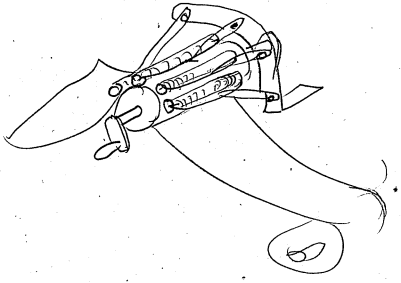
Dropped this at 12 midnight
to go in Rotary auto press thus

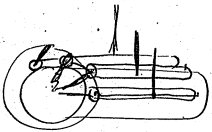


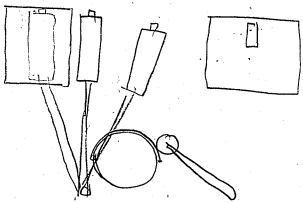
Stencil on felt roller ~~which~~
is soaked with ink (black)

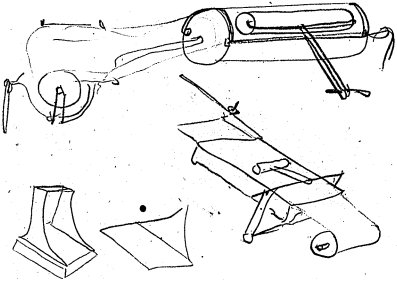
find that even with great
pressure that Copy very faint
+ uneven but if large roller (turned)
back & forward 4 or 5 times
so stencil goes over same
place that no of times gives
very good Copy: tried
Aniline Glycerine ink that
bleed through paper by weakening it &
but not making very good Copy
we now try heavier paper
but think it will be no
good what is wanted is
Second roller going over
large roller in which is cloth
ink stencil over it
~~the~~ & such roller pass
over same part stencil
make good impression

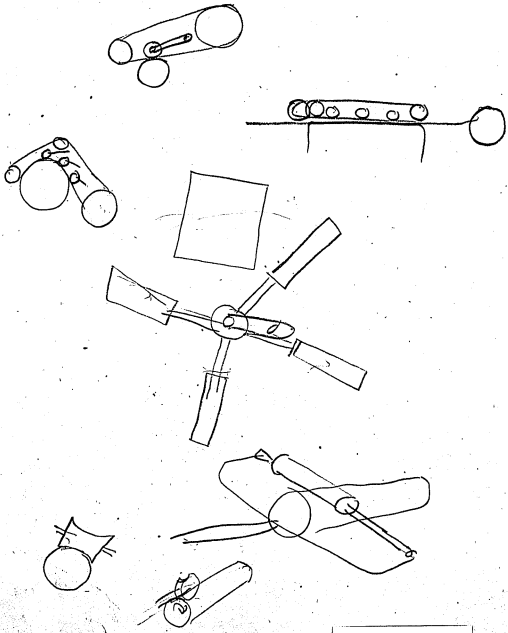
Ktm

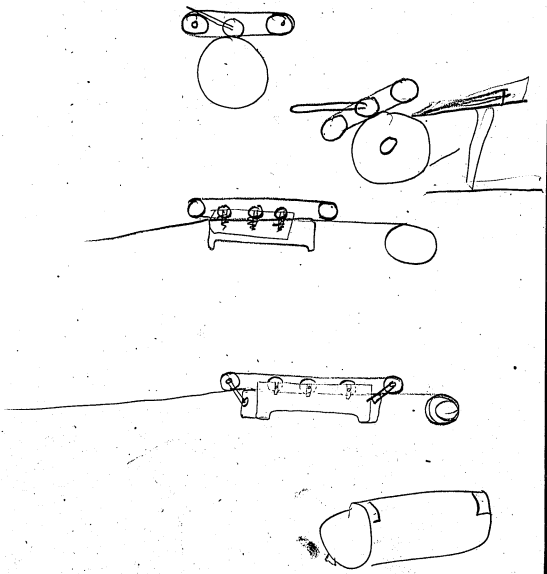






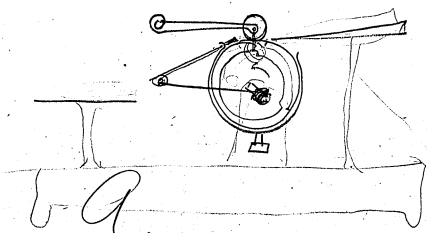






134

Jany 18 1877



Arts Rolling Press

Edison

135

Jany 21 1877

Again we resume the Experiments with the globules of Mercury in various Solution submitted to Electrolysis =

Kerosene oil =
~~with~~ no effect with Electrod. -
Hg dosant cohere together well altho its globules if it is cut through in various directions it is seperated in parts - if beaten it goes all in fine globules which ~~it is somewhat diff~~ dont ~~go~~ go together promptly

a few drops of SO_3 goes to bottom & turns brown reddish very little movement from the H. Electrod to the O ditto - pure Sulphur no phenom = pure Caustic Potash no phenom -

In pure SO_3 Nothing much

136

Aqua Ammonia. Little movement
toward O Ethereal = No
spreading out by oxidation but
there is in Caustic Potash =

Acetic Acid nothing
do - per Caustic Potash.
makes it draw slightly
toward O. =

Oil Peppermint. No
SO_3 not better
Caustick mix

Urbane mix do Caustic Pot mix
do SO_3 mix

Water & little Salt for Cardiac
Camphor chips show no phenomena

Been sick last 3 days. Eyes very
bad Could not do much =

January 23 1874 Commenced on bad
of Standard solutions =

200 Mg. Tannate Quinine
1/64 of an inch movement towards O from
Hg to H. - High resistance makes it bad poly

20 grms Sulpho Carbolate Soda =
Mobile & bright without electricity ═══ attracted toward O 1/16 inch

Mobile with H to Hg; becomes more globular
& sticks to disk with O to Hg =

138

~~[illegible]~~

8 grms Protoacetate Copper -

without Electrode mobile but little blackened } - Absolutely no change of any kind with Electricity

---

500 MG. Carmine No 40.

No Electrode nothing mobile = } attracted considerably towards O. when platinum of O not amalgamated it acts as a sort of make & break jumping back & forward 1/32 of inch, acts strongly then way = perhaps Carbon Electrode work better =

---

5 grammes Acetate Strychnia

Mobile without Electrode } with Hg to O apparently no oxidation it retains Mobility = Attracted towards O. 1/4 inch acts strongly =. lengthens out between Electrode 1/16

---

1 Gramme Lupulin

No Electrode globules but dont move around with freely but after Hydrogen it does = } attracted 1/32 towards O. High R of fluid prevents gravity = its self make & break on unamalgamated O. Electrode -

---

139

20 grammes Iodide Iron

without Electrode
Mobile

Attracted about 1/16 towards O -
with Hg to O dont lose mobility
Know pbly dont oxidate

---

1 gramme Sulphate Cerium

without Electrode
Very Mobile & bright

Attracted pbly 3/16 much towards O.
Dont oxidate or lose Mobility
with Hg to O.

---

5 grammes Caustic Baryta

without Electrode
Moderately mobile.

Spreads out when Hg to O. like
Caustic potash but not so sharp
probably because resistance is
not so low. it does not blacken
like the KO - it is attracted towards

O on 1/32 inch yet between the Electrode
& its 1/8th of an inch = when it has been
fractured by oxidation its quickly
restored by hydrogenizing =

---

20 grms Chloride Alumina

without Electrode
Mobile
but comes up with oxide

attracted towards O.
when Electrode fixed favorably
about 1/8 inch = dont oxidate
or lose mobility with O to Hg -
Not much attraction with
Electrode between -

5 grms Caustic Soda –

without Electrode
Very Mobile & bright

{ when Oxidated Spreads out
Very thin Other Even than
Caustic Potash =

and is very quickly deoxidized
by Hg to H. the attraction
towards O. is small with
Electrode between its small
after oxidation if left to itself
it slowly regains natural position
9 inches after its been flattened
from 3/16 high globule to a
flat sheet 1/32 thin that the

Oxide is very tenacious & brown color
if connected to H the first moment
the oxide becomes black but then disappears
like a flash of lightning.

---

20 grams Sulphocyanide of Potassium

without Electrode
Mobile & bright

{ becomes very globular when Hg to O.
resumes normal condition when to
H. movement towards O. small
greater between Electrode
when connected to H. for moment
& then Electrode placed on Zinc
Sulph. Fenful Current set up Hg
spreads & there is a ripple on top it on a board
and goes at it again when connected to H.

141

1 grm Iodine =

without Electrode
Mobile Bright

with Hg to H. O attends at 1/4
inch scant = slightly brown
Electrode = dont oxidate -
first class selfmk & brank

---

1 gram Sulphuret Barium

without Electrode
Bright mod Mobile

attached Hg-O. about 1/16
dont oxidate = brown
Electrode small attraction,

---

20 grams Sulphat Vinate Sodium

Mobile

attached towards O slightly
when to H & then placed bet
Electrode spreads out greatly
enormous Current set up ridge
on top Mercury then gradually
dies away to be resumed
again after touching Hg to -H.
if Hg to O. it is greatly agitated by
Current & has bright top which
continues for sometime then it
suddenly assumes a more globular
form as steel of knocked for
instance Hg-H. the Hg is again thrown
in violent agitation =

6 grammes Acetate Nickel.

globules but best more with freedom. { Exceedingly small movement towards O. on fractional part of the globule bulges out about 1/100 = no other movement =

40 grammes Cyanide Palladium

Without Electrode Very Mobile. Becomes covered with gas. they leave from it { Attached nearly an inch by O. Very great also between Electrode - its attached 1/16 by H

if connected to O & touched by H. top shews far 10 or 15 seconds beautiful Mirror surface =

30 grammes Hypophosphite ammonia

without electrode not very mobile { Hg to H attached by O. 1/4 inch between Electrodes 3/16 = gas is formed when Hg to H

10 grammes Bisulphite Soda

without Electrode Very Mobile { Attached by O about 1/4 inch it grows here but resumes when Electrodes taken out & put back pbly depolarizes

143

3 Grammes Sulphate of Lithia

Mobile { Considerable movement towards O. say 1/4 at first dies out wont revive = Hg to O. assumes more globular form if touched with H assumes normal & more Mobile Condition

---

1 gram Hypo phosphate Quinine

Not mobile whole globule stick together ~~[illegible]~~ apparently stick to bottom dish

{ Is attracted very slowly by O. at least 1/4 inch after it reached near O. end becomes oxidized & which probably comes in end it retains than about 1/32 = ~~Hg to H~~ dont deoxidize it apparently & it has scarcely any mobility }

---

1 gram Sulphate Coffeine

Not very Mobile { attracted about 1/16 towards O. }

---

500 Mg Acetate Quinine

Not mobile Hg sticks together { attracted slowly & about 1/16 towards O = apparently oxidized = not deox. by H }

144

500 mg Sulphate Silver
Mod Mobile | Covered by Glock ox ~~A~~
not ~~de~~ oxidized by H = attracted
1/32 towards O. High Resistance p6g

---

5 grms ~~fluoride Sodium~~
Mobile | attracted slightly = more between
Electrode = Hg to O great agitation
with current & mirror upward
stop assuming more globular
mass assumes normal condition form
which covered with H

---

1 Gram Cerium
Very Mobile | Is greatly agitated
without touching with
Electrodes the almost alig
in few minutes gently drive to
something — Hg
attracted about 1/16 towards
O. if H + Hg drawn towards
one side of dish attraction is
positive =

20 grms Chloride Strontia.

Very Mobile + bright { Attracted by O. 3/8 ~~of the~~ Gap
Electrodes if it has been
previously oxidized a

15 grms Acetate Ammonia

Mobile { Attracted to O. 1/2 inch
assume more globules form when Hg to
O. touching H to it does
disturb it or resolve it to it
Mobile Condition = when
to O for instant + then put
to H. great Current set up with
a rise in Mercury of 1/16 ~~to~~ in a part
of it just on of a large bubble gas
was under it This dies away + comes
again just like a gas bubble

20 grams Acetate Strontia =

Mod Mobile { Attracted to O 1/4 inch
~~[illegible]~~ doesn't apparently oxidize
but assume more globules appear
+ [illegible] when to O. on touching
with H. [illegible] but of O. diminished & it put to H.
Current setup & bubbles apparently go under Hg + [illegible]

146

20 grams Benzoate Soda

Most Mobile { Spreads out like Caustic Soda & Potash = But not so much = many deoxidized by H = not much attracted by O, when put into it it turn scarcely at all) by O but was less globular all round when to H in closing

4 grms Bichloride Mercury

Next Mobile { Covered with black ox
No movement anywhere

5 grms Salicine

Mobile & Bright { Not attracted very much by O about 1/32 not apparently oxidized or deox

5 grms Chloride Barium

Very Mobile { attracted about 1/4 inch by O. oxidized slightly assuming slightly more globular form deox by Hydrogen

1 grm Baptisia

Most Mobile { attracted 1/4 inch by O.

147

1 gm phosphorist Calcium

Mobility Bright — it slips down to bottom disk when it slips it bulges out slightly in plane (B) not true spherical

Attached 3/4 cm O. mark when Hg & Ca moved up to side disk = appears to be constant attraction not gravity lines = dont oxidate apparently dont attract much bottom Electrodes =

5 gms Metals Zinc

Mod mobility do above

Attraction very slight Coward H O about 1/32 = H Electrode becomes Coated with black deposit

1 gm Sesquichloride Chromium (Precipitate)

Mod mobility

Attached slowly to O about 1/2 mm of Hg kept around 20 or 30 seconds = 9 sec by the parabola of Sesquichl = that the gas or current proceed from the Hg to H in bottom toward the O. There no doubt but the reason that Hg spread is that the path Coward O is Lubricated like the EM Hg =

148

1 grm Sulpho Carbolate Lime =

Mod mobile { Phenomenon = with Hg to H. it attracted forward O ~~and~~ should out greatly it stops for a moment ~~that~~ breaks into 2/3 = going to H. & 1/3 to O - it a grm should out & come together again breaks & so on —

1 grm Carbozolate Ammon.

Many coloured with high oxide brown all mobility flatten out & can be moved as a body ~

When to O spreads outflat but not so much or so fast as with the alkali: it is somewhat deoxidized by H. but not all by it

1 grm Chloride Lead —

Not very mobile { Covered with black Oxide: Scarcely attracted by O. Say $\frac{1}{100}$ —

149

20 grammes Chloride Barium -

Mobile { Phenomenon there is a deposit
Moss like that shoots out like
Tri = on the Hydrogen Electrode
This deposit I believe is
an amalgam of Mercury
+ Barium if so it is an
Exceedingly Cheap way of
procuring it = its deposited
in large quantities, attention
moderate towards O
(used to heat amalgam, on platinum spatula, [illegible])

5 grams Acid Tali Urinum + Potassi

Not mobile. | attended 1/16 by O.

500 mg. Picrotoxin

Mobile + Bright { Nothing much

5 grms Pyrophosphate Soda —

Very Mobile
+ Mag H

attracted 1/4 inch, but
bottom Electrode great
deposit = colour to O
it is Coated with H.
great agitation Mirror x
then stop until again
lowered

---

20 grams Tartrate Iron

Mobile

Nothing Much Thick
thin amorphous formed on H.
on Hg & Fe =

---

5 grms Benzoate Ammonia.

Mobile

attracted to O. 3/4 inch
spreads out like the alkalis,
but not so much as Benzoate
Soda deox by H.

---

1 grm Citrate Magnesia

Mobile

its attracted 3/4 inch by O.
and stretches out in thin wire
breaks at equivalent 2/3 ds going to H
1/3 to O & so on —

20 grams Acetate Zinc =

Mobile { Scarcely perceptible if anything attracted to O.

5 grams Gallate Ammonia

Mobile = { attracted 1/16 to O.

20 grams Ammonio-Citrate Iron =

Mobile { - attracted about 1/16 by H_4O.

1 gram Lactate Iron =

Not mobile. Moves as a whole apparently bound together by an oxide { Scarcely a move.

1 gram Chloride Morphia =

Mobile { attracted towards O about 1/16.

20 grams Iodide Sodium

Mobile { Assumes new globular form to O. between Electrodes. attracted 1/4 inch to H. loss, owing deoxidized by H

20 grams Oxalate Potash

Mobile = to O. it oxidate peculiar the oxide having a Metallic appearance like back of a Mirror, many deoxidized by H. = between Electrode 1/4 inch dilution

---

20 grams permanganate of potash

Mod Mobile { Appears on O like Alkali. & about as much poly permanganate is decomp - with free Na = 9 notice that it is not deoxidized with great rapidity & when it is at 1st becomes black, then great volume of gas given off. meaning = what is the gas? 9 also notice that the gas is given off Edge of globule nearest to the Oxygen Electrode in the Solution, gas goes upwards. =

---

20 grms Acetate magnesia

Mobile { although slightly = 9 notice only Hg to -H. Gas given off copiously

1 grm Tribasic Magnesia.

Mobile | Attracted towards O 1/4 inch

20 grms Chlorate Soda

Very Mobile | Grains very globular on O. deox by H. attraction about 1/16

20 grms Bisulphate Soda

Mobile | between Electrodes scarcely any attraction but on closing the circuit in top Hg was jerked towards H but gave back on opening the jerked towards O. = In fact globule itself on closing jerked towards H + then returns to be jerked towards O on opening = attracted by O slightly

10 grams Chromate Potash

Loses all mobility spreads out | spreads out more on O. partially but not wholly deoxidized by H. = probably could be with longer electrolysis

154

1 gram Arsenate of ammonia.

Mod mobile { attracted 1/32 by -O = Self Vibration

1 gram Phosphate Lime.

Mod mobile { drawn slowly 1/4 inch towards O. but when key worked moderately quite only 1/8th inch

5 gram Hypophosphate ammonia.

Very Mobile { attracted 1/2 inch slowly to -O. With Electrode but not so much, about 1/8 inch.

1 gram phosphate magnesia.

Not very mobile { attracted 1/8 inch by O. but scarcely any between Electrodes.

155

1 grm Tungstate Ammonia

No mobility
Neither in a vacuum

Oxidized by O. & partially deoxidized by H.
Scarcely any movement

---

1 grm Creosote.

Mobile & Bright

Attracted about 1/16 of inch = moves quite quickly backwards —

---

20 grams Acetate Lime —

Mobile

Attracted almost inch = either Oxygen or ~~Hg~~ to H = it also splits and makes long Vibrations 4/5 going ~~to H~~ & 1/5 to O. then Coming together again to 1 m

---

Very Mobile

3 grams Sulphate Aniline
Attracted slightly = Hg to H
Bubbles covered with gas H

156

5 gram acetate Cobalt

mobile | No attraction

1 gram ~~Salya~~ Salicylic acid

mobile | attracted to O about 1/16

20 gram Proto-Chloride Iron

very mobile | slight attraction to O

20 grams Iodide Barium

Mobile | attracted slightly by O.

Not quite mobile | attracted slightly by O.

20 gram Anthracite Palach

Just mobile | Flattens out O like the alkalis [illegible] 100 x dyed by H = attracted [illegible] by O.

500 M.G. Hydrate Chloralis

Mobile | Hg Restless without Electrodes
attracted about 1/4 inch
by O if Hg & H. is taken
up to side of Cup

---

1 grm Sulphate Betarin

Not very mobile | Nothing much

---

20 grms Nitrate Lime.

Mobile at first | by Oxidation loses Mobility
Scarcely any attraction

---

20 grms Chloride Zinc.

mobile | Scarcely any if any attraction by
O = But on closing it is
first repelled for about 1/100
of inch from H then attracted
1/64 by H

158

10 grms phosphor. Wolframic Acid

Very Mobile & bright = | Colored Blue. by O carefully
exposure by Oxidation
form beautiful Blue salt

Mercurigate =

20 grms Iodide Cadmium

Mobile | No movement

Great Hach Hach

1 grm Phloroglucine =

Notably Mobile | attracted to O. about 1/16 =

20 grms Tartaric Acid -

Quite Mobile & Bright | attracted only 1/16 = Hg to H
gives off bubbles. -

159

20 grms pyrolignéous acid

Exceedingly Mobile & Bright { attracted only slightly

20 grms Chloral Hydrate

Very Mobile & Bright. { rolling round

20 grms Lactic acid

Very Mobile & Bright { Scarcely attracted G.O.

200 M G Molybdenic acid

Not Mobile Movements slow { Scarcely attracted from its coated with oxide before put Glid. in with Hg to O mus oxidized not to any great extent deoxidized G.H.

10 grms Chlorate Magnesia. Solution full crystals but its Very powerful

160

Experimental Notes
J. Ong 21st 1877

Platina - Solution

No 1

Platina Solution Jany 21st 1877.

Take Oulein oil 1 Part Acetic Acid 1 part and a few drops of Sulphuric Acid reduce it down with about 10 times its bulk of water and you will get a nice green mark on Oxygen

a little more Sulphuric gives a Blue mark not

[illegible] fixed cyan Potash makes a very [illegible] solution

[illegible] gives a dirty green

[illegible] mark and [illegible] gives a fair mark

[illegible] changes the color of the mark to a

[illegible] I think makes the mark more

[illegible] delicate I think the mark will

[illegible] Williams

161

~~Nitrate~~ of Uranium of Potash dont do it any good
Acetate

Chloride of Lead very delicate but fades very quick

Bromide Potash kills the green mark

Cromate Potash turns the solution greese
Blue mark on a. Perhaps [redacted] Permanent

[redacted]ngnate Sodium no change in solution
the green mark

[redacted]
iron no change
Perm[redacted] mark
Zinc no change
[redacted]
[redacted]ate Soda almost kills the
[redacted]nge in solution

[redacted]s change
[redacted]nia kills the green mark
Brown

[redacted] Cromcim no change Permanent
[redacted]

Oxalate Soda no change

Cyan. of Silver No change in solution
gives delicate mark on J. Slight m[illegible] on
H. on Platina only

Bi Carbonate of Potash no good

[illegible]ate of Potash Kills green mar[illegible] [illegible]ating
[illegible] No Change in the a[illegible] on [illegible]
solution

[illegible]mple Changes Solution. [illegible] milk white
[illegible] mark more delicate

Sodium no change

[illegible] Kills the mark

Makes the Solution
[illegible] a green Blue mark

Chlorid Sodium What this is

Ammonia Citrate Iron turns Solution
brown mark not very delicate but comes
out a bright green afterwards

[redacted]

Nitrate of Lime no good

Anthracate of Potash no good

Glycerotricine they dont mix
no good

of Ammonia [redacted]
no good

Sodium no good

ronticin no so delicate gives a
but turns green in time

no good kills the mark

dont hurt the mark
hat it does it any good

Chloride of Ammonia
kills the mark altogether
good for ink

Boracic acid dont appear to
affect it in any way

Acetate of Lead makes it less delicate
brown mark at first turning green
short time

[illegible]lic acid kills the mark dead

Iron gives a deep blue mark
[illegible]ing to a green dont think it
[illegible]manent try again

[illegible] alt dont appear to do any

[illegible] makes it very delicate
[illegible] green mark the best of
[illegible] yet. Turns the solution
[illegible] mixed a few minutes

permanent

165

Jany 24th 1877

[redacted]

Nitrate of Silver very delicate and a very deep green mark very neat as good as Lunar Caustic

Nitrate Strontia almost kills the mark

Nitrates Ammonia no good

Magnesia no good

ramic acid good for mix

nesia kills the mark right out

[redacted]

now very nice mark not Permanent

mark fades no good

good old first Chloring

but when dry

166

Nitrate of Lead dont appear to do any good

Aniline Red in a solution of water & nitric
Acid added to untill it destroys the red color
a little of ~~this~~ the acetate of Aniline & to the acetate solution
gives a violet mark on short circuit and a
green mark on 10.000 ohms
very delicate solution try this again

Acid dont mix with Aniline

Oil

Butyric acid dont mix with Aniline
no good

Hypophosph acid dont mix with Aniline
no good

Oxalic acid no good

Yantar's [illegible] makes tartrate of Aniline which
is soluble in water it gives the green mark
same as Acetate & Sulphate & Nitrate but
not quite so delicate nor so Permanent
as acetate with a little Sulphate

Gallic Acid no good

Citric Acid combines and makes Citrate of Anilin is not very delicate. Wanted to experiment

Some more on this

Jany 25 1877

Tungstic acid with a little Sulphuric acid gives me a green mark on O. But I dont think that Tungstic is at all soluble And the mark is due to to the Sulphuric alone

Chromic acid no good

~~Hy~~ Hyphuric acid no good

Camphoric acid no good

[illegible]nglic acid dont mix with anilin

[illegible] a little Sulphuric acid it concentrates

and [illegible] ball that dont appear to be soluble [illegible] or only a small part of it

Phosphomolybdic acid with a few drops of Sulphuric acid forms a salt soluble in water gives a green mark on O and very delicate and I think permanent

Valerianic Acid and a little Sulphuric combines with Aniline and gives a dark blue mark but soon fades to a Brownish gray are very delicate water in excess Blue mark turns ~~[illegible]~~

use a solution of Acetate of Aniline with other Chlorides for conductivity

Nitrate Soda no good

[illegible] copper does not improve I say

Lithium [illegible] delicate turns solution clear

Aniline Red with Nitric Acid makes the Aniline Solution less Delicate for mark with a tin pen

Chloride Lime turns Solution blue no mark

Bi tartrate Potash very good

Phosphate Manganese very delicate on 10 000 ohms but fades out

Protochloride Palladium it dont mix with the Aniline Solution nor can you Boil it but by Putting a Strip of Paper in to tube you can boil it easy but they dont mix the lower Solution gives a green mark Permanent but not over delicate by Again

Hydrocyanic Acid dont improve it much but makes it more Permanent

Sulphuret Potash no good

170

Wood Naptha very good to 11.000 ohms but fades slightly by Heat

Bromide of Mercury no good

Carbonate Amonia no good by putting the two [redacted] Electrodes in to the solution turns it blue no mark

Protochloride of tin no good

Gum Arabic no good

Chloride Calcium this solution will only mark on high resistance. It gives nothing on short but as soon as you take out 8000 ohms gives a first class mark. damn funny

Jany 28th 1877

[redacted]

I think the best solution found yet with Platina pen is Aniline oil (standard) Acetic Acid. Small amount of Sulphuric Acid and about 10 times its bulk of water and add to this a little Iodide Potass which makes the solution very delicate the Iodide ~~Cyanide~~ mark will fade away. And there will remain a greenish yellow mark which is Permanent

Jany 27th 1877

Take a solution of Aniline Violet and the standard to this add a very little Nitrate of silver and you have a very delicate solution giving a mark through 30,000 ohms with 3 cells carbon it is a Permanent green use standard without Aniline Violet only and the silver green mark on clothing but turns black this solution is very delicate gives a mark on 80 000 ohms but I don't think it is quite so delicate as the first-mentioned

172

Standard Amem Violet Silver

Standard Metric Silver

173

Ethereal force Feb 14th 1877

20 grams 100 cc H_2O Ferrocyanide of Potash Decomposes it and forms a salt shaped like a brass mesh

Trial the following kinds of Electricity to do the same thing

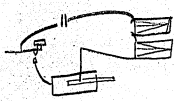
1 Cell Carbon through 200 ohms coloration on H
" " " ditto on O.

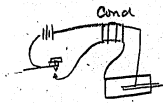
1 Cell Carbon through 600 ohms " H
" " " O.

1 cell Carbon through 1100 ohms " H
" " " O

1 Cell. Carbon through 1200 ohms slight H
" " " O

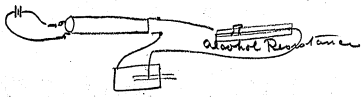
1 Cell Carbon through 2400 ohms nothing H
" " " O



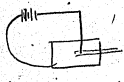


treat the above with strong potash in a solution of ferrocyanide of Potash get a small spark and coloration on paper

one cell Carbon get no spark ~~one~~ but get a slight coloration both on H X O.



made it very weak so that I would get no spark slight coloration on the paper



Bichromate of Potash on dead short Ch — O two to Pend gives a kind of red mark after dusting on paper for 15 minutes on H. a kind of White mark it dont appear to be anything of the same nature as others decomposition

Nitrate of potash excess carbon
on short ch — O nothing H nothing
James Adams

---

trying to decompose different chemicals
with different metals by Etheric force
Feb 15th 1877

20 gram 100 c.c. Ho.
Lactate of zinc
Iron Pen down nothing
Iron " up nothing
Lead " up Lead mark — nothing
Lead " down —
Nickel — down Nix
Nickel up Nix
Silver down Nix
Silver up Nix
Zinc down Nix
Zinc up Nix
Aluminum down Nix
Aluminum up Nix

176

Sulphate of ~~Cad~~

Cadmium 20 gram 100 cc H_2O,

Aluminum	down	very slight coloration
"	up	
Iron	down	Nothing
Iron	up	Nothing
Lead	down	Nothing
Lead	up	Nothing
Lead	down	Nothing
Nickel	up	Nit
Nickel	down	nit
Silver	up	Nit
Silver	down	Nit
Zinc	down	Coloration with or without Ethere

Ferrous Cyanide of Potash 40 gram 100 cc H_2O,

Iron Pen down gives a blue color and forms a salt with or without Ethere

a solution of salt & H_2O with an Iron pen gives a blue color without Ethere

With Ethere it gives a blue mark and forms a salt

ferrid Cyanide of Potash

Lead Pen. down Blue Coloration
Lead " up — — — —
Nickel down nothing
Nickel up — nothing
Silver down gives a yellow salt —
not in the form of a bucs nest but —
that might be owing to the shape of the pen
but it shows a solid mass
tried it without Et Rye but could
get nothing
Zinc down forms a kind of a salt —
looks like Iron one
Zinc up ditto
Aluminum down nothing
— — — up nothing
My Jungotate of Soda 5 Gram 100 cc H2O,
Aluminum down nothing
" up nothing

Tungstate of Soda

5 Grams 100 cc H2O

Iron pen	down	Nothing
Iron pen	up	Nothing
Lead	down	Nothing
Lead	up	Nothing
Nickel	down	Nothing
Nickel	up	Mix
Silver	down	Mix
Silver	up	Mix
Zinc	down	Mix
Zinc	up	Mix

---

20 Grammes 100 cc H2O

Chloride of Nickel

Zinc	down	Nothing
Zinc	up	Nothing
Aluminum	down	Nothing
Alu	up	Nothing
Iron	down	Nothing
Iron	up	Nothing
Lead	down	Nothing
Lead	up	Nothing

James Adams

Feb 18th 1877

Hydrate Potash		20 grain 100 cc Hₒ
Nickel	Down	nothing
Nickel	up	nothing
Silver	Down	Nix
Silver	up	Nix
Zinc	Down	nothing
Zinc	up	nothing
Aluminum	Down	nothing
Aluminum	up	nothing
Iron	Down	nothing
Iron	up	nothing
Lead	Down	nothing
Lead	up	nothing
4 grain 100 cc Hₒ	Bi Chloride	Mercury
Lead new	Down	nothing
Lead	up	nothing
Nickel	Down	nothing
Nickel	up	nothing

Silver Down Nothing
Silver up Nothing
Zinc Down Yellow coloration
~~Zinc up~~ gives a dark coloration
Without Ethers
Aluminum Down Nothing
" up Nothing
Iron Down gives a Black coloration
get the same mark without Ethers
Bichromate of Ammonia
20 Gram 100 cc H_2O.
Lead Down nothing
Lead up nothing
Nickel Down

20 grams Oxalate ammonia

40 Caustic soda

1 gram Nitrate of Strychnine

182/8

182

Merlo Laboratory

Jany 23. 1877

No 5

El Dr. Jorge Mercado

J. Cobarle

Continued

5 grms Sulphuret Calomel

Not Mobile | Hg to H spreads out = attached slowly by O, slowly deoxidised by H.

1 grm glycerolmel.,

Not very mobile | attached 1/8 inch by O.

20 grm Ag2 quadrilateral 2 grm

Very Mobile | attached almost as much by H with O to Hg as the other way = Mercury (that adhers) to O plate ~~[illegible]~~ turns black peel off

20 grm Sulphuret Copper

Globules & Mod Mobile | Phenomena attached by H only

5 grms Gum Tragacanth

Mobile

attracted 1/4 inch by O
when Hg & H on side dish

5 grms Arsenous Acid

No mobility = Spreads out
flat & gives no movement
whatever with Electricity

20 grms Oxalate Ammonia

Very Mobile

Attracted by O. inch -
attracted by H. 1/4 inch

forms a ammonium amalgam
Swells up greatly = doesnt
move very greatly but Electricity

184

5 grms Calomel mul sulphacum

Not very mobile | attracted 1/16 inch by O.

1 grm Caustic K 25 grms gum gamboge

mobile | attracted 1/2 inch to O.
doesnt spread much but oxidates
with O to Hg —

1 grm Caustic Pot 5 grms Venice Turpentine

mobile | Swims a brave

20 grms Sulphide of Antimony

Not very mobile not spread | attracted to O about 1/8 inch

20 grams Metallic Lead

Phenomenon before touching Electrode

black oxide accumulate which moves with
[illegible] and accumulate in a heap on
top of globule

over

this oxides before it reaches the top of the globule looks like Metallic Lead =

Moderately Mobile | Not attracted by O. a little by N

---

5 grms Gum Benzoin 1. Caustic Soda.

Mobile | attracted 1/4 inch by O

---

5 grms Shellac 1 Caustic Potash.

Mobile | attracted 1/4 inch by O

---

5 grms Glycerine

Mobile | attracted 1/8 inch by O
Stiff mix & break

---

5 grms Caustic K 5 - Balsam Tolu
acts like same Potash Solution

Mobile

40 grammes Caustic Soda

Funny this solution instead of flattening out as it should doesn't much but acts very funny its scarcely attracted by O.
but greatly by H spread out 1/2 inch = when it is say it respond to more better than any gas seen
when diluted it spreads but promptly

Hydrochloric Acid strong
attracted by H only
about 1/4 inch
bubbles copiously given off
Hg to H. oxidizes
in every shade with Hg to
O it is blackened by bringing
H near globules by the hydrogen

Model

Nitric Acid, Shaking
When first poured in
divides the Hg up in snake
like parts which wriggle
around & finally are
attacked so showing that Cant
see the Hg = passing Current
either by O or H don't stop
the reaction except near the
end when O to Hg stops it
slightly

1 grm Bi Tartrate Potash
Not much good

Metals

1 grm Benzoic Acid
Not much good

Excellent
Metals
to Bright

188

5 grms Balsam Copaiba
1 grm Caustic Potash =

Mobil. | attracted at first 1/4 inch to .01 = goes greatest distance between Electrodes

---

5 grammes Phosphate Manganesi.

Mobil | attraction great = 1 inch or more only 1/8 between Electrodes = Oxidizes slightly with Hg to .01 but many deoxidized by H

---

5 grams Microcosmic Salt.

Mobil | ~~spreads~~ attracted as much as above & between poles it spreads fearful at least an inch this ought to be good for the pumping action in Capillary Tube Quality

189

1 grm Acetate Strychnine

Mobile | not much good

20 grm Grape Sugar

Mobile | not good

Monochloracetic acid

Mobile | not good

Lacto-phosphate Bismuth

Mobile | not good

1 grm Perchlorate Potash

Very Mobile assumes very globular form with Hg to O. naturally rising by Gravity to H. attracted slightly by 1/2 inch. Not near so much but pull. O.

190

20 grams Iodide Zinc

Mobile | Attracted same distance 1/32 inch both by O & H

Very Mobile | 1 gram Chloride of Propylamine — Attracted 1/2 inch by O. none by H. between Electrodes not quite so much varying

---

10 gm Hyposulphate Barryta — Notably Mobile | Attracted 1/8 by O. but 1/2 between Poles — Barium Hg-Amalgam formed on H Electrode - plentiful

---

1 gram Iodide Arsenic

Mobile | not much movement — if globule allowed to roll above solution it gets a mass which shows most beautiful brilliant Color by heat (10) after the hand and sensation

5 grams Sulphate Uranium

Mobile	Not much good
Mobile	Unknown quantity Per Nitric Gra. U 9
Exceedingly Mobile	1 gm Nitrate Strychnine Attached 1/4 inch by 8
Very Mobile	1 gm Iodic Acid Attached slowly about 1/4 inch by ++ only
Not Mobile	1 gm Chloride Uranium Attached to O about 1/8 inch

1 gram 400 mg

Luna Caustica.

Not very Marked

Blackens Hgs =

Scarcely any attached by O

1 gm Sul Cinchonidin -

Not marked

Slowly attached for 1/2 inch by O.

1 gm Daponin =

Not very marked

Not very good

3r gms Chinic acid

Marked

Not good

3r gms Vdicinate Potash

Marked -

Attached 1/8 by O.

Got better Got Pali

20 grms Iodide ammonia
forms ammonium amalgam
in large quantity + syrupy

20 grms UVic acid
not much good. Matter
that the scum on the
top of Hg moves +
responds with rapidity to
Magnet, this forces matter in
many Solution = probably
best movement could be got
here with light aluminum
point horizontal with
pipe or cork disk resting
on Hg would go. more
pressure get electric
points.

18 grms Valerianate Potash

Mobile | attracted 1/2 inch by O.
When Hg to H by holding
O near Hg there is a
raise in mercury which soon
undurns to H when it
bust out sidewise showing
it is gas

That's all the
solutions of the
100 cc

Chloride ammonium
from an amalgam
its attracted
3/8 inch by 1/4 t

Nothing that phospho-wolframic acid gave a sky blue Calomelan with one of the Hg globules = I now go to work to ascertain what was it that gave the Calomelan whether a poralloxide of Hg or something in the Hg by analysis =

Nitrate Hg + P.W. acid clouds = Nitric acid redissolves =

Bromide Hg – no.

Bichloride Hg – no.

I now take a fresh globule of Hg + pour phosphowolframic acid on it again the blue Calo appears

~~Not~~ Cyanide Hg – no.

Thinking it might be Zinc

in the Mercury

Sulphate Zinc — no
Acetate Zinc
Valerianate Zinc

Pure Phosphor doesn't reduce Phospho-W acid to a blue.

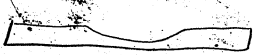
If globule Hg is put in test tube with the phospho-W acid & shaken liquid turns blue & more its shaken bluer it gets = if much water is used it almost destroys color = this shows that it is the oxide of Hg or something in the Mercury

I have found it = its Zinc with Mercury - which has a little acid in it left over from amalgamating the Zinc at first.

Fresenius says: a phosphoric acid solution of an alkaline Tungstate (10 wolfram) gives a beautiful blue with Zinc = I found it so = this is a good test after Telegraph people burning Hg

Curious Experiment on Mercury globules =

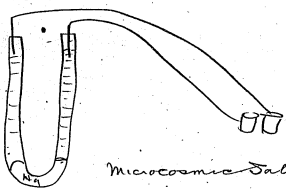
Carbon plate with hollow cut in it



The Hg in 20 grm. Sol Caustic Soda. without Electrodes keeps up a surface current with coloured rings. They have continued for 10 minutes & will play continue long time nothing very strange Ace

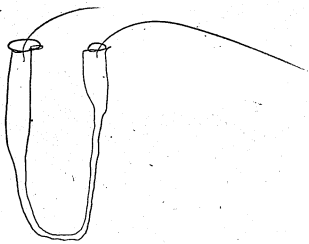
With Hydrochloric Acid nail
change =

I now have a bent U tube.



Hg moves towards Oxygen Electrode
about 1/32 of an inch on closing
Key = It rotates too Easy to work
Mercurwell = diameter bore
tube about 3/16 =
I notice that the water passes
freely from one tube to the oth
between the glass & the Hg

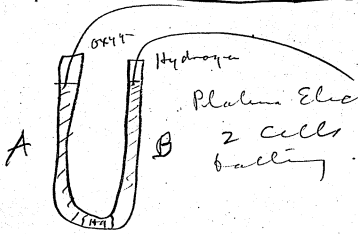
I have now made another Capillary tube



with considerable Hg & copper electrodes it is easily moved with platinum moves much better but not so well as in flat dish I got less Hg in now

The tube I drew didn't answer well = gone back to U tube 3/16 bore small Hg in bottom + SO_3 + H_2O, dilute =

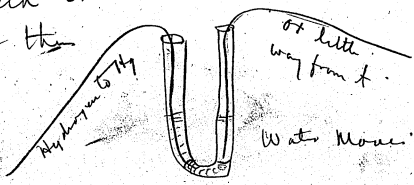
Thus



Platinum Electrodes
2 Cells Carbon
boiling

Through 10000 ohms water
moves in A. $\frac{1}{200}$ inch & flowers same
rate in B, it responds good
to Morse ⊤

With the U tube & with
Hg the



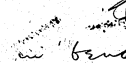
up in A & down in H. $\frac{1}{100}$ $\frac{1}{64}$ to $\frac{1}{32}$
inch quite sharp through 24000
ohms with 1 Cell Bunsen

It dont work at all with reverse
Current the reverse Current
or O to Hg sticks it &
it dont recover for several
minutes ~~with~~

~~By the way, I have [illegible]~~

~~Yes~~ If it had a capillary
bore it would move
along distance =
SO_3 + Water dont act
anywhere near so well
besides this aint pure
Hg there's lot Zinc in it

I find that with the tube 3/16 bore
that with 2 cells Carbon it moves 1/64
through 36000 ohms = it moves sharply
& plainly through 70000 ohms = $\frac{1}{100}$ of
inch = With magnifying glass
magnifying double it moves
plainly about $\frac{1}{300}$ inch through
70000 ohm with <u>one</u> cell
Carbon battery = this above with
5 grams <u>solution</u> phosphate Manganese

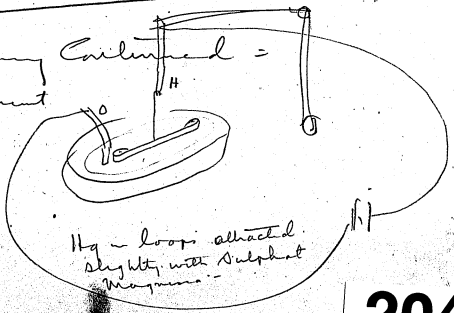
Been trying RO_3 = & 40 grams Rubbish
Magnesia = but there no doubt
but 5 grams phos <u>Manganese</u> is
best = I find that when
the Hydrogen wire is made
in a loop.  this & dipped
in Hg in bend of tube and drawn
up as far as Hg will adhere
without breaking that the water
rises & falls a great distance
hence weight more sensitive. This puts Hg
on a tension =

Deustmann. Shange Co say appears to measure as the O. wave is ~~not~~ just pit in liquid =

Note = acetate aniline, + solution perchloride palladium in test ~~tube of liquid~~ tube. two solution dust mix – if heated, a large bubble 1/4 diam comes up from bottom solution occasionally with a thump. but if pieces Bibline paper be shade in Enormous amount gas comes up and liquid boils = this shows that two liquids are above other or liquid that boil by jerks. Can be prevented by a biblus paper, or other substance connecting bottom with top.

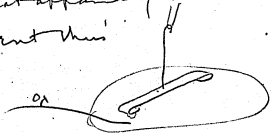
Mercury Cathode =

Experiment

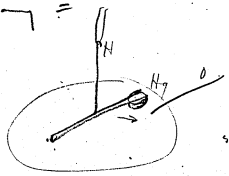


not attached with Solution 20 grms Caustic Soda & with 5 grms Phosphate Manganese not apparently attached. =

but this



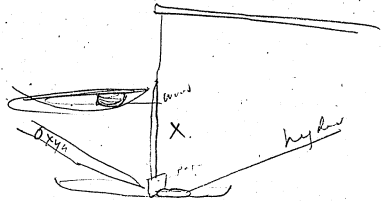
it takes. (18) when ckt. closed the Hg in loop is squeezed so to speak out & reaches to bottom drop & on bkg ckt is drawn up by analogy Capillary =



on 1800 ohms 2 cells it attached by 0.1/16 inch = the globule hg in bottom drop but

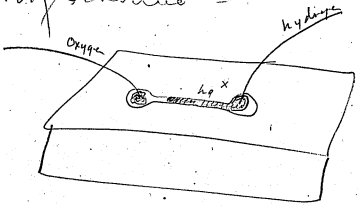
3000 ohms makes $\frac{1}{64}$ 6000

Ohms $\frac{1}{200}$ = 2 cell Cabr



with 5 grammes solution phosphate manganese
paper moves 1/64 inch through 12000
ohms —

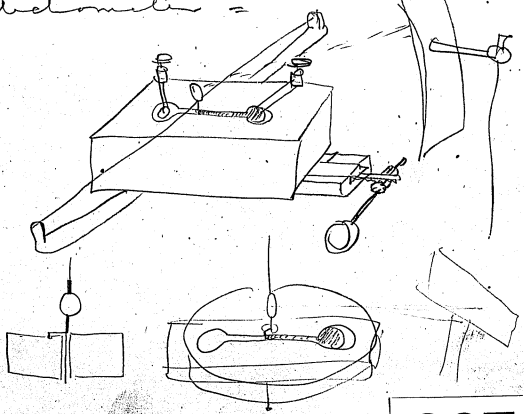
Very Sensitive —

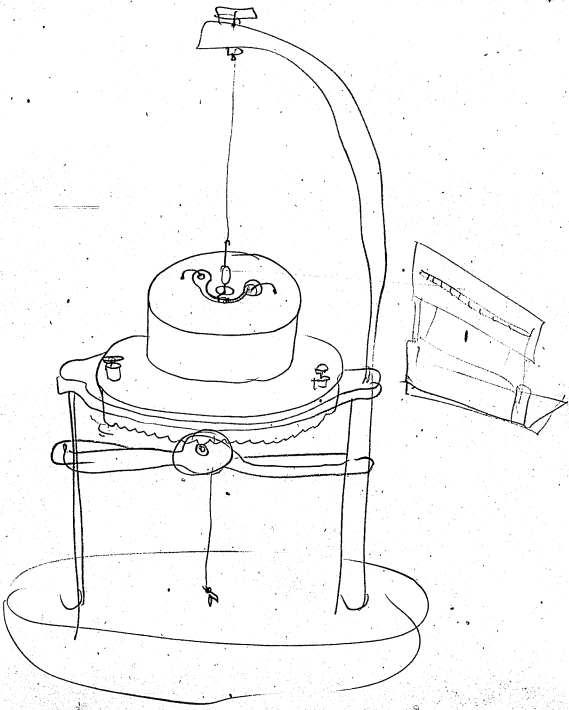


groove cut in paraffine about 1/8 wide &
about 1/8 deep. Connect ▭ this
with rounded part at each end
with 5 gram solution of phos
Manganese; end of hg. X. is allowed
towards O. with 2 cells Carbon

$\frac{1}{64}$ inch through 70,000 ohms
& $\frac{1}{100}$ with 1 cell through same
resistance: Thus scarcely any
solution in bottom cant see any
just manat poly if too much
solution not so sensitive,
the long tail of the Hg must
be manipulated for sensitive
& can get no movement.

I propose to make a Mirror
Endometer =





When a saturated solution of acidulated of manganese (it may be neutral manganese possibly something else must test it) is used as an ink on hard writing paper the place where this solution touches the paper it swells up greatly fully the thickness of the paper & suffices to lift a circuit closing lever & do work with a battery = We employ it now in our autographic telegraph experiments to open & close the circuit by moving the lever on the Emq principle (Le) by the difference of friction between the rough & smooth paper & the smooth & glazed surface

We tried the following but none so good as the acidulated manganese –

Glycerine & No – No good

Acetate Mercury acts somewhat like Acetate Mercury but not near so good

Nitrate (Lead) + Bismuth dont raise but surface paper a little rough.

Prussiate Iron - little better than lead. surface rougher

Ferrocyanide of Iron very

Phl Barium fair.

Acetate Hg & KO, nearly as good as the Acetate Manganese

Sulphate Aniline & Sulphuric Acid

[illegible] g [illegible] d

Ferrocyanide Copper very

Chloride Zinc, not quite so good ~~as~~ standard & has disadvantage taking long time to dry - whereas the standard dries immediately

Acetate Lead neg

Black Flux + HO neg

Oxide Copper - rubs off neg

Bichloride Tin neg

Oxide Copper + Gum Dextrin fair.

The Standard is perfectly satisfactory & we now are trying to obtain a dye to Color it with so as to make good [illegible] ink

We have been trying various Inks & Experiment to make

porous papyrographic paper. We find that the acetate of manganese is the best, if you use a moderately thin hard writing paper in with the strong solution of acetate

of manganese it does not go through but if after drying it be dipped in water

with the working down
the water comes through
almost instantly then
by using the glycerin aniline
shellac ~~gu~~ for copies may be
taken

glorious sunshine by
all the
house are in the days
orian used
warm of the
aged man

The above is a specimen
taken in this way.
If a piece of bublin pap
be coated with a

one side or both sides
~~[illegible]~~ with a thick solution
of Shellac & then written
on with the Manganese
Oxide & soaked in Water
It makes a beautiful
Stencil. You must keep
printing with all the
[illegible] of our discontent made
glorious summer by this sun of York and
all the clouds that lowered upon our
house are in the deep bosom of the
ocean buried [illegible]

Manganese [illegible] ink Stencil
[illegible] it dries &
[illegible]
glorious summer by [illegible]
all the clouds [illegible]
house are in the deep bosom of the
ocean buried [illegible]
the Stencil cases to be
proof but may be soaked
again with Water

the use nor nitric in the
glycerine ink & its the very
Unchecked glycerine, perhaps
if water were used it would
give splendid results.

We have a pen & ink & water
proof tissue paper sold by a
man in Connecticut that
with the manganiferous ink
works well. the head of the
pencil is [illegible] fitted with
it = must be soaked
in HO = 9 parts that hydrochloric
acid dont do well but mixed
with acetic works well
the proportions ought to be
varied & further Experiments
made

Conceived idea of working with a gum mix + then dusting it over with fine gritty substance, passing through roller the idea being that gritty stuff would break through paper + form a stencil. Tappia Cork would. I thought it ought to be run through Metallic Roll with great pressure.

Caustic Potash, Soda, Barium or Strontia Salt act near as well as Chalk Magnesia

I think that is the
Manganese Acetate ink
mass etc. are up so high
it might be used for the
Blind in Correspondence ?

Hydriodic acid gets right
through the paper in [illegible]
but good ink [illegible]
Aniline ink [illegible] though
Smoked [illegible] Carbolic
Calcish [illegible] a Valuable
Iodide [illegible] —

217

The Battery was so strong
That it ~~was~~ Burnt the Land

[ITEM FOUND IN BOOK]

With this [illegible]
Contributions
thicte shell me
& their in
white
Hemingway [illegible] [illegible]

Now is the winter of
our discontent made
glorious summer by

Now is the winter of
our discontent made
glorious summer by

57 E

225

This is
James Adams

adjust it
last have bell.
Sheak Lower

copper band too
Mark
as it on the ribbonwire
am a w better
make a tin for lind if
Maccoa the copper

8
2 3 0

230

I it mepeaf just
as I can
the band in front of the disc and gummed
to rubber ~~dappragm~~ will do it the last you
pend. come load and heypra do it again
make band e so it will be flexible
good talk some more Nothing
not hing
not cubent got nothing
~~I go~~ got nothing
no yes first part total last
part too total
yes
Allright. Now i will i will go get
spa. come ~~Dapper~~

231

ther go — the shunt

~~is the matter~~

231/8

ap piles of folks in y and

a big crowd in every day

~~yes sometimes when a d as d it~~

~~comes p id~~

Nod no Tyou better

put the parchment of

rubber over the diam mean

put a d of the lead

~~Read you R~~

yes

You mean put on shunt

the big diaphragm

Best yet de

Best yet can read c follow y

it is touching
no thing
I have made a thinner rubber and
you is putting lead on it B
be ready in a little while
the Rubber Has got so small a surfase
that it has to be put on Thick or I cannot
get any current through it
~~put on all the Battery~~
Put on all the Battery
Have you got any Battery
on this wire when I cut out
my Battery
how lo
talk low. have
no thing you got it straig
ht
got nothing lah
time.

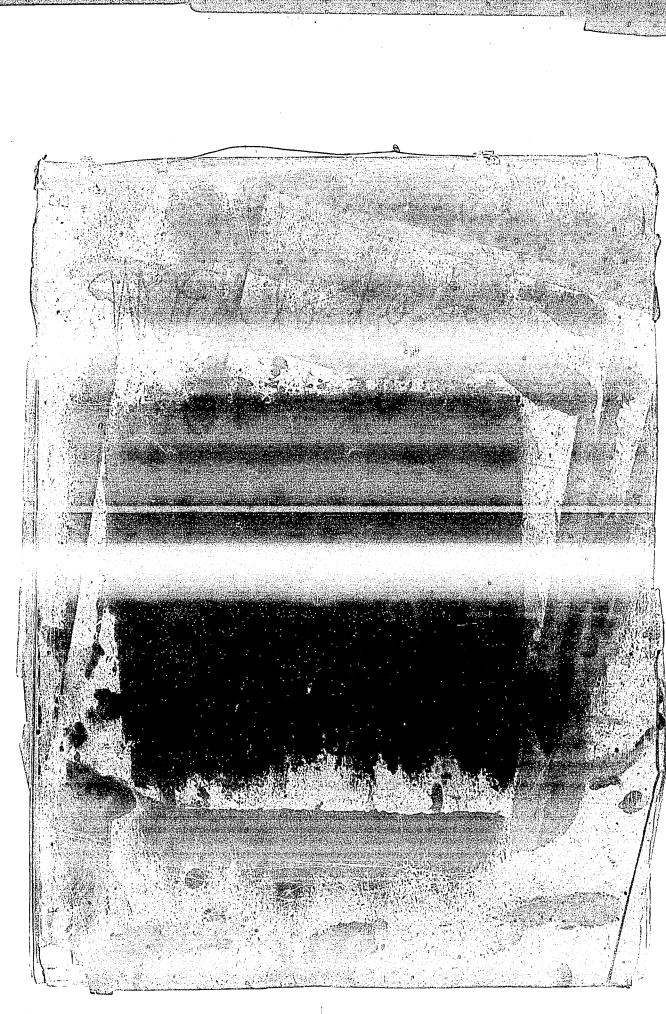
No ramrod talalaa it ax
the matte

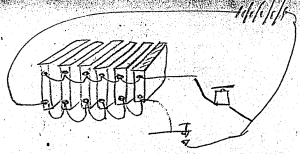
232

We have 60 cells of Calcium & we are making 20 of the carbon. —

O.K. We wont be over to night so you might
yes you can see
how long wo you be ready it is go going
to fix your battery the big dam

lo close
lo far put it closer and get the
ghl the rubber straight
o the arm in of mare ver
good si-sing
Im sung the ach
What
vilclose r
ohennot hom g.
Battery is to strong Burned uh Im for
put on 1 or 2 cells or a few
carbon
the Hertoo it se
c it is better but to close

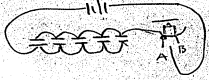




Callaud battery
70. cells.
not first class

5 Phelps Condensers. M7. 1.9 Capacity +
the red condenser = 1.6
2.5
1.6
1.6

on closing battery key, a current (momentary) closes sounder. (Bunnell) on opening an opposite current closes sounder: this is correct as on closing a route is formed for discharging the condenser on opening both poles of the battery are free to charge the condenser.



Phenomenon, on closing on-a + not through the sounder. The spark (snap) takes place with contact only on closing fuse on B it

does not scintillate and you get the steady
Electric Arc without scintillations only the
opening - why - perhaps Self induction
of the magnets =

We are now adding Condensers and battery
got 110 cells = with hand Malograph & I
notice that with Copper wire
Aluminium gives brightest
sparks & that + Lead gives Loudest
Cracks = With non the spark shows
Scintillation ~~[illegible]~~
closer together ~~than~~ &
more abundant & larger =
appear thus

While Aluminium shows less
abundant and there are mixed
sparks some appear like iron &
others are thick & bright. while iron
are thin & yellow = these bright
Scintillation are in the Ends
being turned down

the iron also have (10) some of the scintillation a forked end =

Nickel Zinc, Copper Tin Platinum give much less scintillations, Copper to Copper scarcely any.

Lead & Iron, give much finer than iron to iron = and the forked ends have more prongs = & in some cases the scintillations are not seen until an inch or so away there is apparently a break in em =.

Phenomenon If a piece of metallic Silicium be placed between two metallic or Carbon poles & many pulses passed yet red hot a

Labrate
not!

Continuous Electric Light with
Snaps is obtained. ~~Ive~~ I
~~Ex~~ have the Condensers as
Connection first part
of book I have no double
but a piece of silicum would
serve to keep the Carbon
points of a common
Electric Light going
Constantly ~~&~~ Lithium
does same thing but only for or
a time until its valuable ed
which is not the case with Silicum
Baron gets very hot & keeps
hot if small gram be used
but does not act so well
as Silicum.
Of all Metals Magnesium
Ribbon gives best
Scintillations but they
don't hoot out so far as iron

Putting Paraffine on metal &
using Copper wire to slide
through it great snap &
flash of fire. 1/4 diameter looks
wicked & like an explosion of paraffin
in new vacuum of paraffine =
Salts dry =
Chloride Lime nothing explos
Camphor. acts like paraffin
probably explosion only effect of
confinement of spark —

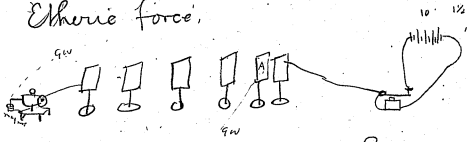
Starch Sul Copper neg
Nitrate Potash neg
Oil Sweet almond neg
Borax Pot neg
Salt pretty good —

237

Nitrate ammonia Salt
Eucalyptus to brown powder
Dyspnoea. neg.
Coca buds acts similarly
Putting in Rheostat with
200 or 400 ohm in wire lead
to Emg kills sparks.—

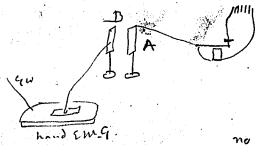
238

Etheric force.



With 6 sheets of suspend foil on glass rods
Each foil ~~having~~ being 12 X 8, and the total
distance 4 feet get spark quite often in
Etheriscope. with 10 ohm spool connected in
place of ground wire by grounding A
makes no difference in getting spark at Etheriscope.

If connected thus.



With Iodide Pot 20 gm to 100 cc. get no spots
Showing decomposition ~~[illegible]~~
~~[illegible]~~ but appears to be faint tinge
though this may be due to pressure
of platina Loop - but when platina
connected direct to A get good
spots in 2 minutes, the spark is very
with platina shows scintillation ¼
to ½ inch long. When Platina to B
sparks a bright with no scintillation
Using Connecting to B filters the E
from the true Etheric

I now propose to submit all the H_2O solution to the decomposing power of the ether. by allowing platina point connected both to A & then to B to rest on strip of paper for several minutes.

=

Sulphate Zinc = nothing

Ferrocyanide of Potassium 20 grms 100cc = = salt =

Phenomenon - after 2 minutes there accumulates a salt on the platina at the point where it rests on the paper: under the microscope - low power 1/4 - it looks like a piece of salt that runs over model of battery ~~was~~ called =

I try it again get same salt but less in amount probably because the paper is dry I now by a new strip of same = gives same salt = I now try a little wetter strip still gives it somewhat better = I now try on quite wet, salt appears almost instantly

I now put a piece of wet strip on the platina of Emq & laying the platina Etheric current at the point of contact = same salt but not so much in amount = gives twice the passage of current from 2 cells

But gets nothing on the oxide & a blue Coloration on other = Evidently the Etheric decomposition is not the same as the Electrical from 2 cells at least

Ferricyanide Potassium = Reg Auto Sal.
only a slight greenish coloration
on one side a bluish general spread
out down on the album

---

1 gram Mono-chloro-acetic acid = mix -
20 gram ditto = exceedingly faint yellow
coloration just seen with 1/4 power in
microscope

---

20 grms grape sugar 100cc = mix

---

5 grms 100cc Microcosmic Salt mix =
1 gram - Phosphate Manganese = mix
1 gram Lacto-phosphate Bismuth = stirring vigorously
300 milligrammes Bromide of Mercury mix -
1 gram Perchlorate Potash = mix,
5 grms Sulphate Uranium mix
1 gram Acetate Strychnine mix

241

10 grms Hyposulphite Barium nix

1 gram Lactate Quinine nix

1 gram Iodide Zinc = nix =

1 gram 400 mg. Lunar Caustic = nix

20 grams Iodide Ammonia nix

5 grams Valerianate Potash nix

20 grms Nitrate Uranium — slight yellow dot in 5 minutes

5 grams Uric Acid nix

I notice that first the crystals completely cover the bottle inside & within the liquid like frost on a pane of glass = in 5 gram Valerianate Potash =

Nitrate Uranium 20 grms — I notice that on strip near top of bottle where evaporation has concentrated it = paper is completely disintegrated & is like mush in the fingers =

242

5 grms Citrate Ammonia = I notice that the strip immersed and in contact with this solution but not above it is colored strongly flesh color. This is a very strange Calorimetric for this salt and = The strip has probably been immersed 3 weeks or perhaps 1 month

Mix in Ether

---

2 grms Binoxalate Potash = mix

20 grms Bisulphate Potash = 1st strip shows in 3 minutes a birds nest of a salt which rises up around sides of platinum like that in the ferrocyanide of platinum but not near so delicate a reaction = Wet new strip same but no so strong

---

20 grms Phosphate Soda = Mix

1 gram Oxalate Potash = mix

5 grms Tartrate Potash mix

243

I am now going to put in a
Quad Reversing Combination so I
can reverse the direction of the
Ethric force if such a thing is possible
by reversing the battery =

Very important experiment proving that
Ether Currents are not reversed
Because with Ferro cyanide with the
battery Current in one direction I
get the bird nest salt test strongly
whereas the other way I get
nothing to speak of though under
Microscope can just see the slight test
bird nest poly due to salt many
from plate underneath though
Jap =

---

5 grams Acetate Baryta - Quadrons Sons
up =

grams Ferrocyanide. Ammonia. up = slight
yellow red spot on yellow paper
= still sharper. yellow
quite strong

5 grammes Citrate Potash down mix
up = mix

5 grams citrate Magnesia up - mix - down
mix

3 grms Oxalate Soda - down + up mix

5 grms Acetate Baryta up + down mix

5 grms Tartrate Potash down up mix

5 grms Lactate Zinc up - mix down mix

5 grms formiate Soda down mix up mix

5 grms Sulphate Cadmium up - mix down

20 grms Potassic Hydrate = down mix

5 grm[illegible] Chloride Nickel up - mix down mix

5 grms Fe[illegible]anide of Potassium - down
[illegible] not litely stain on up =

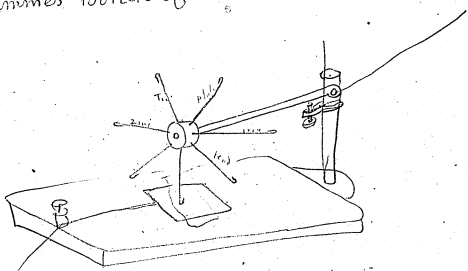
1 grm P[illegible]hate Potash up - down mix

245

5 grammes Tungstate Soda down = mix up

4 grammes Bi-chloride of Mercury = up mix down mix

8 grammes Borate of Soda down mix up mix



Machine for Etherolysis.

Gron

5 grammes Bicarbonate Potash = up mix down mix

20 grammes Sulphate Magnesia. I notice paper covered with a thick white Pumice semi-transparant, this is queer for a Sulphate - down mix - up mix. I try a fresh strip down = mix up mix

10 grms Bichromate of Potash - up slight red opax with Birds nest quite sensitive. down same Colouration perhaps more but no Birds nest - with 2 cells ~~[illegible]~~ shortest gas gas no colouration 3 minutes

5 grammes gum arabic. down + up mix

1 gramme Gallic Acid up, + down mix

5 gramme Pyrogallic Acid. down. up - nothing

20 grammes Nitrate Potash. up. + down Bird nest

salt = appear colorless under microscope

but to naked eye there are spots = appears to

be an equal deposit on up and down, not so

sensitive as Bichromate of Potash or Ferrok.

40 grammes Bromide of Potassium down + up

get bird nests one greater than other. forgot

which - I use the old strip in bottle to

determine which gives most = now up-

down work so well as fresh paper I now

by fresh paper, but it will require

special precautions to ascertain

because the strip becomes dryer

the up gives very deep birds nest dilts down

gm with 2 cells gets no reaction whatever, short circ both poles

5 grammes Bromide Cadmium, down + up mix

8 grammes Chlorate of Potash, mix

20 grammes Phosphate Ammonia, mix

10 grammes Formiate of Copper. mix

40 grammes Nitrate Ammonia mx

40 grammes Nitrate Strontia. Bird nest good on up.
not so strong on down but strip dries =

20. grammes Carbonate Soda. Small Bird's nest

20 grammes Sulphate Soda. Bird's small nest on down
only

I notice in Carb Soda 20 gm fine mica like crystal
over above regular crystals + in iodide

Iodide Palassium 20 grammes down -
good. Red mark but I dont think reaction
is so great as Bird's nest after the ferrocyanide,
~~[illegible]~~ stronger on up = it shows
clear through showing free iodine
given off at all points =

I now put it so Ether must pass from
one fool to the other 6 inches = think
I see faint mark but doubt = Ether
burns very strong

20 grammes Hyposulphate Soda, get a faint black Calcination but think it was due to dirt on platina & clean ~~strip~~ platina & put in new strip

it was dirt

1 gramme Chromic acid = mix vapor dam

20 grams Common alum mix

20 grammes Sulphate Zinc = mix

20 grms Tartrate Soda = mix

10 grms Tannic acid = mix

1 grm Arsenate Quinine - mix

5 grms Arsenite Soda mix

5 grms Vibrunate Ammonia mix

1 grm Acetate Soda mix

1 gram Sulphate Cobalt nothing

1 gramme Carbazotic Acid - nothing -

1 gramme Carbonate Lithia. no good.

14 grammes Acetate Urinum - mix

20 grammes Arsenate Soda. mix.

20 grammes Manganate Soda. mix

1 gramme Nitro Prusside Sodium - mix.

5 gram Amygdalin mix

1 gm Chloride Copper - mix

5 gm Hypophosphate [illegible] mix

1 gm 500 mg. Cyanide Silver mix

1 gm Cyanide Mercury mix

20 grammes Sulphate Iron good

gues. two faint spots in dark black granules -

8 grammes Proto-acetate Copper dom.

faint blue made in 1 minute

Note & notice in this bottle two crops of crystals 1st faint blue color deep intense green: 2nd - strongest blue green =

250

1 grm Protoacetate Copper = mix

20 grammes Iodide Iron

500 mlg Cairmne no 40. mix

20 grms Iodide Calcium good red spot on down shampa m up

the Calcium Iodide is a good ifnot Gell then Iodide K.

1 grm Sulphate Carium mix

20 grms Sulpho Carbonate Soda = fine spot m up + down

5 grammes Manganate Potash, mix

5 grammes Acetate Iron

5 grammes Acetate Potash mix.

1 grammes Sulphate aniline mix

20 grammes Sodic Hydrate Pleburia auto down m p m apparently a Coloration, =

20 grammes Hydrobromate of Ammonia = Buds nest Crystals

251

20 grammes Chloride Lithia mix

5 grammes Stannate Soda. Yellow spat

20 grammes Sulphurettede Sodium mix

1 Gramme Sulphuret Barium mix

6 grammes Acetate Medical-Chemical Co

20 grammes Sulpho Cyanide Potassium. mix

5 grammes Caustic Baryta. mix

20 grammes Chloride Alumina. Chemical

1 grame Iodine = mix

30 grammes Hypophosphate Ammonia mix

10 grms Bisulphite Soda. mix

20 grammes Chloride Cadmium

20 grams Cyanide Potassium = Yellow spat

20 grams Protochloride Tin Yellow spat

20 grms Acetate Lead - mix

20 grammes Sulphite Ammonia, Chemical

5 grams Acetate Uranium & Potash. Mix

1 gram Chloride Lead.

20 grams Chloride Barium Bird nest

252

5 grammes Pyro-phosphate Soda,

5 grams Phosphate Manganese.

20 grms Tartrate Iron Red Spot up & down best yet More sensitive than Iodide Potassium = fades

5 grms Salicine mix

20 grams Benzoate Soda. ~~mix~~

Beautiful Brilliant crystalization deep and polished inside with a white rim = =

20 grms Chloride Stronti mix

1 gram Phosphate Calcium mix

5 grams Nitrate Zinc mix

20 grms Acetate Strontia mix

5 grms Fluoride Soda - Pale yellow spot family sensitive. Can the fluorine which has never been isolated -

Common Salt

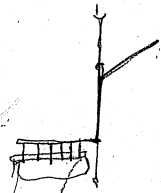
Phenomenon

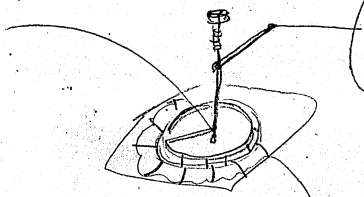
There is a very deep birds nest formed and this nest is on top of a platform of crystals which appear just like an Queen Elizabeth ruffled collar to cover the top of the nest & perfectly round and raised up from the paper to very sensitive reaction, with Ether disconnected nothing = I feared it might be a crystalization from the Cal ~~micro~~ metal = This salt reaction is what makes the Tornado made of Potassium & Salt Solution work though the reaction is different. I will test this soon If paper ~~[illegible]~~ not very wet dont get the Elizabeth ruffle - I now dry a drop = of sol.

Conductor not any reaction with
drop =

Chloride ammonium Bird
nest crystallizes peculiar
w. this =

255





Specimen Test

16
1 8
4
2
1

Fig 14.

1897

256

E-1686
vol. 8, sheets
258-363; Aug.2-
Aug. 18, 1876.

Sheets $\frac{258}{8}$ to $\frac{363}{8}$

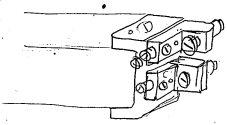
Sketches

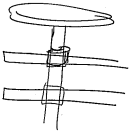
760802

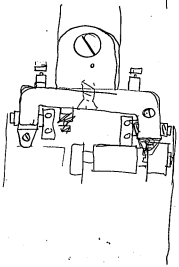
Aug 2, 1876 — Aug 18, 1876

Experimental Researches

Acoustic Transfer
Aug 2 1876
T A Edison







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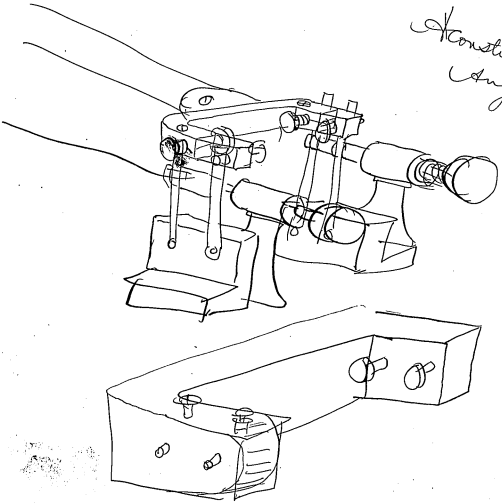
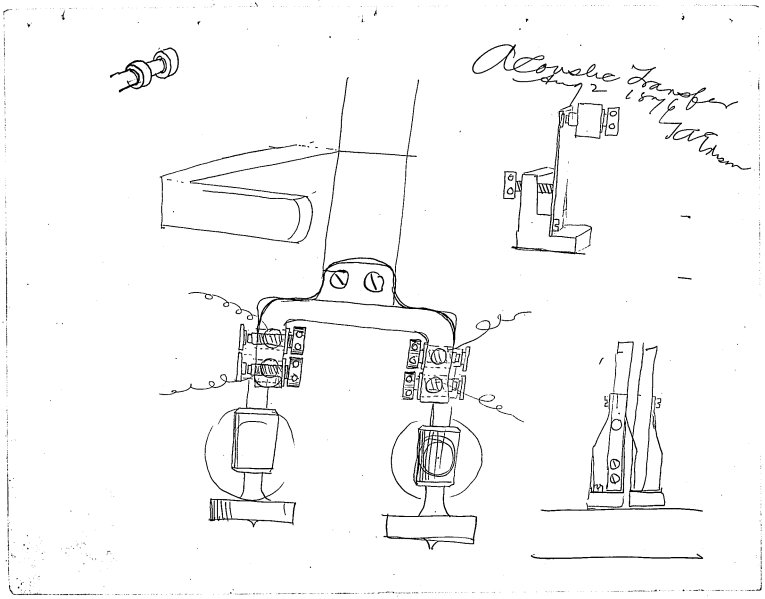


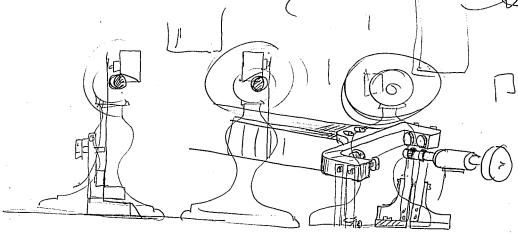
Acoustic Transducer
Aug 2 1976
Tillson

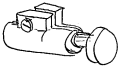
258


Acoustic Transfer
Aug 2 1976
Tatham

Acoustic Transfer Stage

Aug 2 1896





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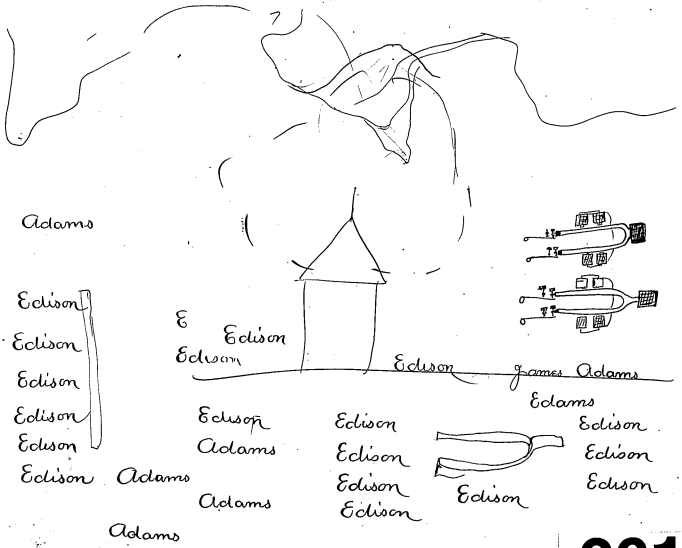
Adams
Edison
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E
Edison
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James Adams
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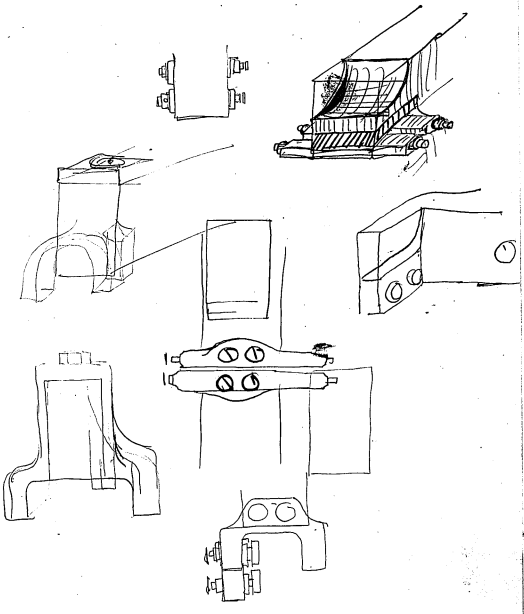

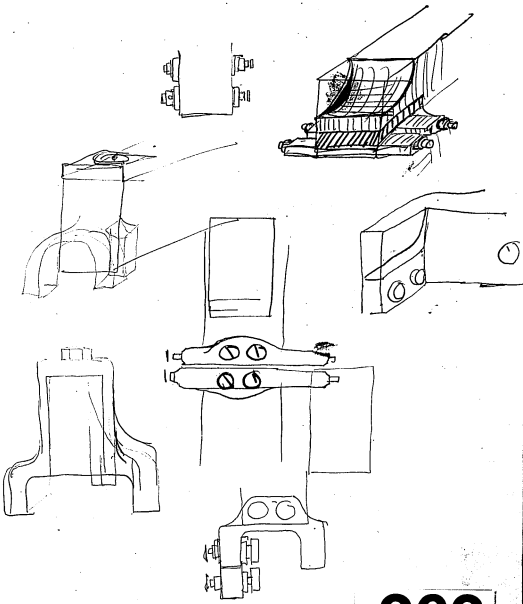

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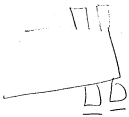

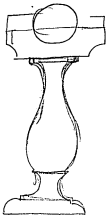

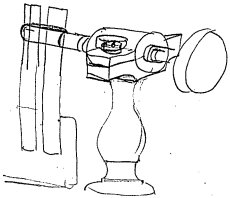

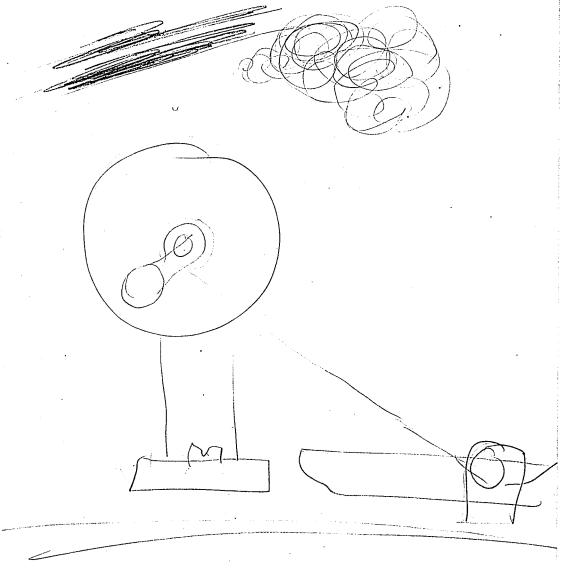

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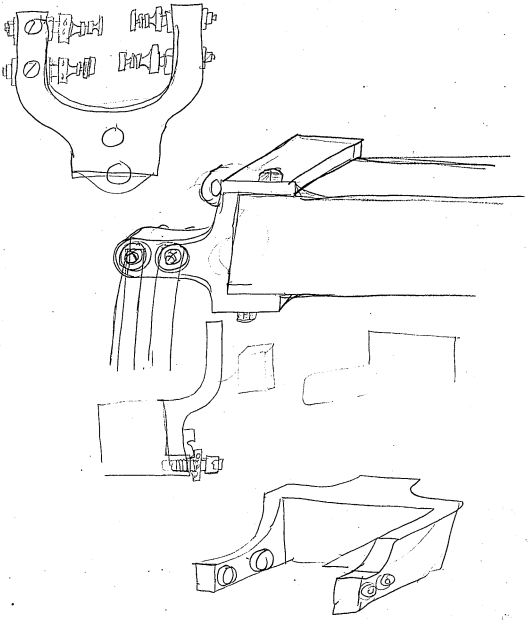
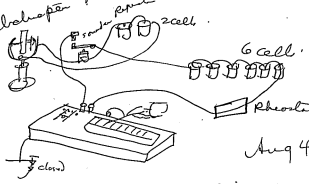


265

Electromelanograph Experiment



Aug 4 1876 J C Edwards

Standard 3000 ohms pyrogallic paper same as made for Domestic, phelms pen =
Hydrogen — vibration just ~~see~~ felt

O.T.H. – Bi Sulphide Carbon Acetic Acid – nothing on 3000,
N. Alcohol + Caustic Soda, will work equal to
pyrogallic through 30000. ohms the paper owing
to evaporation of alcohol is quite dry
in few minutes gets perfectly dry. it
works quite strongly through 70,000. ohms
all we had – by opening + closing the key
+ stopping + starting the vibration
the effect ~~is increased~~ deflection is
greatly convenienced as the hand can readily
detect the stopping + starting of the
vibration = ~~Very plain through 70~~

266

We now take Cornutina ~~Potash~~ Soda + Alcohol as a standard, vibrations when key is worked being clearly felt through 70 000 ohm

O+H Alcohol + Oxalic-A. nothing felt at 70000,

Silver + Cop on Ag - Alcohol + Tartaric acid vibration just perceptible not so good as standard

O+H. ~~Pot~~ Oil Sweet Almond + Iodine nothing surely felt

O+H Oil Turpentine + Creosote - nothing felt

O+H. Oil Rosemary Cone' - nothing surely felt --

O+H. Spirits Turpentine + Glacial Acetic acid nothing felt yet when key open apparently feel some vibs it may be that the sol is of extreme delay & requires perfect and invariable to stop vibs =

267

O+H Bisulphide Carbon Glycerol Acetic A.
nothing felt since =

Bi Sulph Carbon - Creosote nothing dries
almost instantly =

Spirits Turpentine + Iodine nothing
felt =

Bi Sulph Carbon - Spirits Turp = nothing

Spirits Turpentine Hypposulphite Soda Nothing

Spirit Turpentine - Carbolic acid - Nothing

By pulling away from hand EMG so = Cured at
all. Vibration apparent
feel Mechanical vibs - could tell better,

Alcohol & Tincture Chl Zinc. just feel
on H =

820 P.M. Cor start again =

268

Bisulphide Carb - Turpentine - Glacial Acetic A
on H. quite plain on Nickel + more plain on platina
apparently nothing on O.

Turpentine + Ether - apparently nothing =
Alcohol & Iodide Potassium fair on Aluminum
on H - apparently increase on O on Tri but
feature is very faint =

Alcohol + Acetic Acid very good
probably near standard on H - best
when on Silver or Cop = nothing on O.

Alcohol + Molybdaenic acid - on O
strong increase friction when on platina
only - on H. strong test on Silver + Copper =
+ head - better best about same as
standard = Dries too quickly =

Alcohol + Bromide of Potassium Nothing
" Fused Zinc Chloride "
Acetic Acid Fe deluth "
Ammonia Hydrate + H_2O. "

269

Bromine + Oil Rosemary		nothing
Turpentine	Fuming Nitric a	"
"	Bi Sulph Carbon + Iodoform	"
"	Chloroform	"
Rosemary	Caustic Potash	"
Turpentine	Wood Naphtha	"
Glacial Acetic	Acid	"
Cocoanut "	"	"
Oil of Sweet Almonds + Rosemary		"
Rosemary + Iodine		"
Turpentine	Creosote	Fuming Nitric a — nothing
Bi Sulphide Carbon, Cyanide K + Iodine		"
Spirits Turpentine	" Potassium	"
Ammonia	Strong	"

Caustic Strontia + Alcohol
first class nearly as good as
Standard delicacy decreases
rapidly on Evaporation of Alcohol
Nitrate Zinc + Alcohol = GOOD. = nearly up to Standard
best on Aluminum + Nickel — nothing on O.

Alcohol + Hypophosphite of Ammonia,
great increase fraction on O. on Silver + Copper
N. not so good as standard, better when
strip is little dry — when wet fraction not
noticeable,

270

Best yet

Alcohol Bisulphide Carbon + Caustic Pot
better than Standard =
paper want to be little dry
+ hard pressure on point

Alcohol + Castor Oil.
Not good as Standard as
an increase friction greatly on
O. not good on H.

Alcohol only about as
good as first standard (12)
Can. Soda + Al.

Alcohol + pyrogalate ~~as good as~~ better than
1st Standard

Alcohol + Sulphovinate Soda -
Not good not better than
2nd Standard (12) Al Bi Sul + Can K.
quite fearful increase on O. even stronger
Change the dec on H

271

Oil Lavender + Glacial Acetic Acid Nothing
Alcohol Glacial Phosphoric Acid "
Oil Sweet Alumnos + Desquichl Fe "
Water + Salt — Nothing =

// Best yet 3rd Standard

Alcohol + Nitrate of Uranium = ✕
Make further tests

Alcohol + Iruen analine = very faint =
Alcohol + prato Fe — perhaps smtg on H
Turpentine HCl — Nothing
~~Fe~~ Bisulp Carbon HCl + Iodine "
Alcohol Castor Oil Caustic K Nothing
Alcohol ~~Chl~~ Chloral Hydrat. Fair about
Same as No 1 Standard =
Alcohol Carb Ammon about as good
✱ as 3rd Standard

272

Alcohol & Methylene Blue about as good as 2nd Standard in A
get weak when paper dries =

Benzine & Iodine = mix

Alcohol & Aniline Brown mix

Benzine & Oil Turpentine = mix

Alcohol Salicylic Acid
Concentrated Solution mix

Alcohol Camphor & Glacial Acetic Acid mix

Alcohol & Salicylic Acid — mix

Alcohol & Starch about like
" 2nd Standard and like Alcohol itself

Alcohol & Grape Sugar
" Same as above.

Oil Mirbane, Alcohol & Nat Cryst.
" good if not better
than 3rd Standard

very good ppt. drying out well =

Alcohol & Red Aniline
Increase in O on Tri fair deb

273

Oil Mirbane + Oil Sweet Almonds Mix

Alcohol + Iodine "

Bi Sulph Carb + Turpentine. Oil Mirbane + Benzin Mix

Benzine + Glacial Acetic Acid - mix

Alcohol + Blue Aniline mix

Alcohol + Bichromate Chromium not mixed good -

Glacial Acetic Ether Nearly 1/first

Equal 3rd Standard fuchsine

Expert

Alcohol + Acetate Mercury -

Equals = 2nd Standard =

Bisulphide Carbon Bichromate not mixed good

" Oil Mirbane "

Oil Mirbane + Glacial Acetic Acid

just dissolved it

Oil Mirbane Bichromate Mix

274

Alcohol & Bi Chromate of ammonia
Increase fraction greatly on O,
~~do~~ Effect disappears when ppt nearly dry
Alcohol & Tannic Ac — Mix
Bi Sulph Carbon Olive Oil & Iodine — Mix
" Cod liver Oil — Mix
Olive Oil alcohol Bi Sulph Carbon & Hydrophobia
Almost as good as 3rd
Standard

~~Turps~~ Oil Rosemary Carbon Bi S. — Mix
Bi Sulph Carbon & Castor Oil — Mix
Carbon Bi Sulph & Sat Sol Chl Fe — No good
Oil Rosemary & Sesquichl Fe.
Oil Mirbane & Iodine.
Alcohol & Cochineal,
Spirits Turp Bi Sul C & Iodine,

275

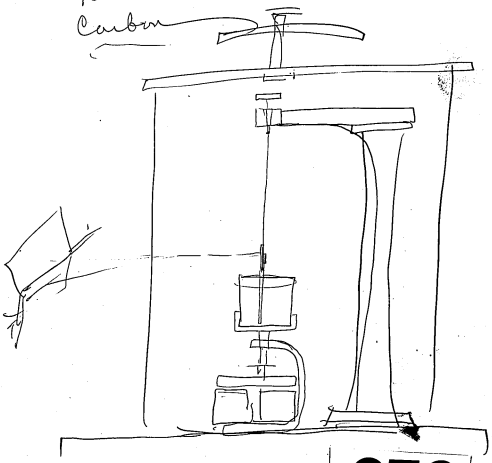
Alcohol & Sesqui Chl Iron mix

Alcohol & Nitrate of Lime nearly as good as 3rd Standard =

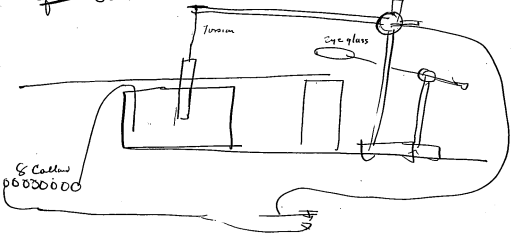
Alcohol & Monochloroacetic acid, mix,

All the preceding through 70 000 ohms with 6 cells

Carbon



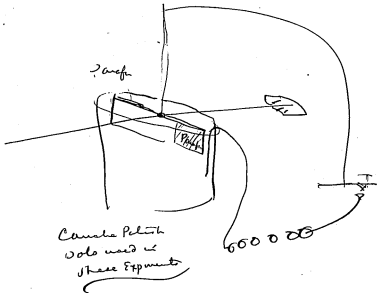
Tried suspending a piece of lead in a cup kept rotating by Clockwork, But as the clockwork wouldn't rotate only for a few seconds & my dimes were very crude did not get right result ~~for~~ But one little unsuspected



on closing the cylinder of lead rotated ~~to each second~~ & thereafter made an oscillation of about 1/32 inch slowly to right on closing & did it several times.

Tried a flat paddle

Suspended by loosen wire

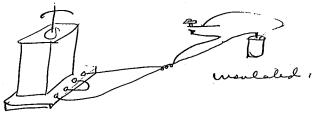


The opposite sides of these ends were paraffined, in closing points showed considerable deflection,

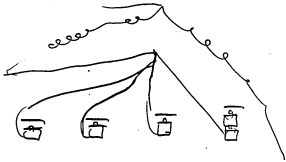
Aug 6th 1876.

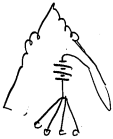
Tonight ~~tried~~ on our Mirror Gal found that it was hard to keep it at zero, = with I Daniell or other Collard found that it was extremely delicate unexpectedly so. if there are no

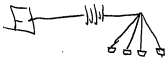
Sources of error



got deflection of 12 degrees with wire twisted as shown. Then brought up the Elliot Thomson & had lot of trouble to get it to zero & at last broke the fibre in the endeavor hence couldnt compare =
I think the Elliot Mirror is too clumsy =







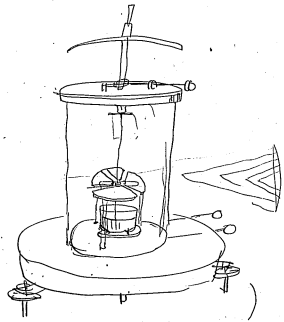
Keep carefully

Experimental Notes

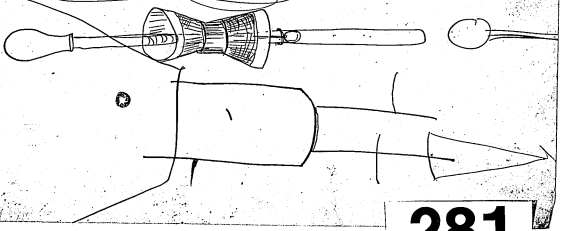
Last page E. M. Gray

to relays & telephone

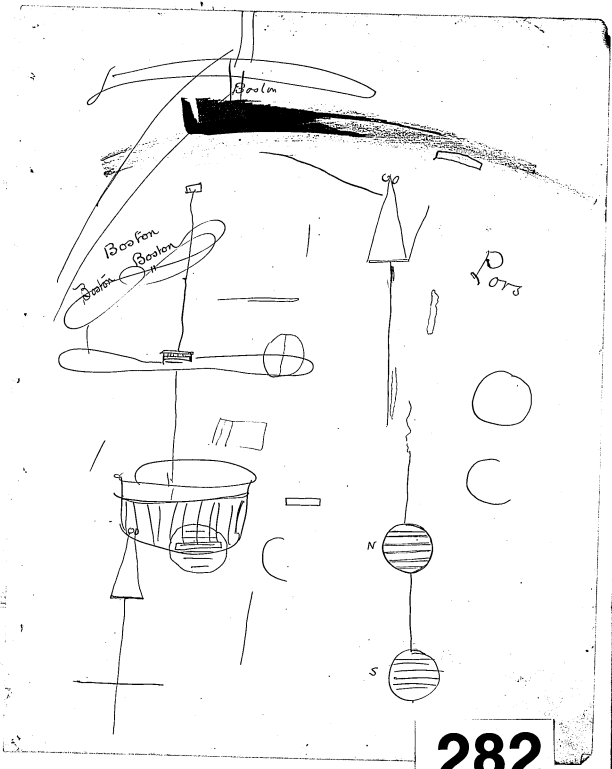
In my Quadrant Electrometer the glass of the Leyden jar was white shellac'd appon had - the jar does not hold the Charge hence I propose to make a hard rubber Leyden jar -



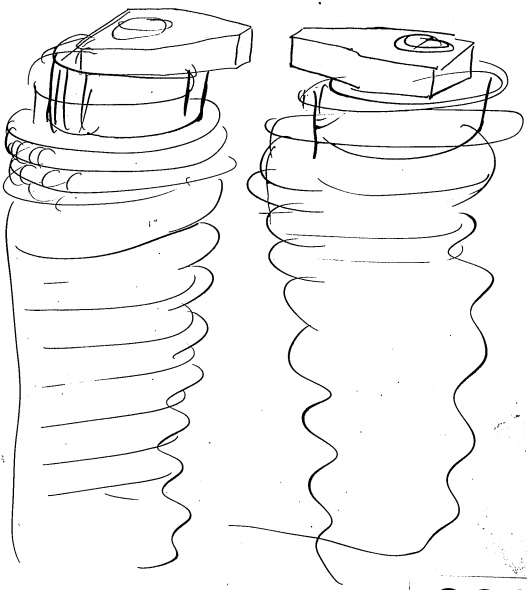
Hand Electrophorus



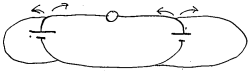
281

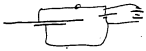


282



283





I have an idea that each particular combination of element & exciting fluid in a galvanic battery give out electricity with diffrent rate of vibration in the same manner as the vapors of metal in a flame are proved by the prism to have diffrent rate of vibration hence I have announced the idea that with a cell filled with certain chemical solution & platina electrodes that 100 units of current from one source will pass through that solution in greater quantity that 100 units from a diffrent source; in the same manner that the heat from Hydrogen will pass through

a Solution of iodine in Carbon Bisulph than from a Candle or even from another source of light & heat of greater intensity. If the rate of vibration of the Electricity be the same as the vibrating Molecular time of the liquid through which it passes very little Current will pass but if different it will pass readily. Hence I conceive that the Static Current passing out of a Submarine Cable has a different rate of vibration than that due to the primary battery Current hence I propose to filter the primary ~~[illegible]~~ from the Static or Secondary Current by a liquid whose time of vibration is the same or an multiple thereof of the static Charge. Should I be unsuccessful in obtaining the I can simply

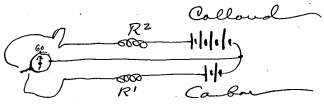
another liquid and two
signalling batts of which
produce the same change in
the Cable but whose absolute
time is different and I want
a certain liquid that will
allow the current from one
batty to pass through readily
Easily while the other does
not pass so readily - hence the
Cable will be constantly charged
& Rapid signalling will be
obtained = I try a preliminary
Experiment this Evening

July 30 1876 -

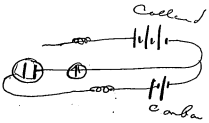
T. A. Edison

287

Aug 2 1876



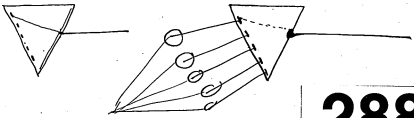
R1 & R2 are made so that the deflection from either battery will be the same = Then



60,

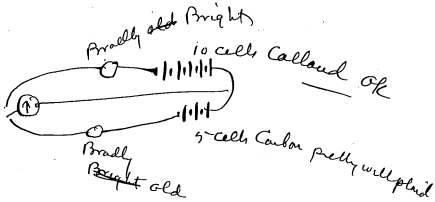
45.

- Alcohol
Bisulphide,
Solution in Carbon Bi Sulphide,



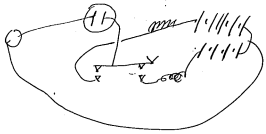
288

Experiment on the different vibrating times of Electricity produced ~~by~~ from different Sources

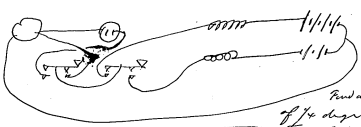


again [redacted] Calland 5 9 Carbon 58½

Put on Key thus



Have now arranged it thus —



Find a difference only of ½ degree as not have thus balanced before

No 1 Coil 65 10 Collaud 1020 R
" 1 " 65 5 Carbon 1000 "
with Copper El - Ho = 59 on Collaud —
again 59
" 59
Carbon 58 1/2
again " 58 1/2

Aug 7/1876

Re heated direct both touch 65

— " —

I add now 2000 ohms in each resistance coil - when it is perfectly balanced there appears to be a difference of 1/4 of degree between them Even when the balance is against the one giving the lower deflection = I now decrease the resistance to as low as possible so that resistance of Electrolyte will move noticeable - Balanced about 600 in each - 75 - same difference 1/4 degree - I try no 2 coil now makes about 1/10 of a degree lower on Carbon yet on balancing Carbon is little the strongest - I now add about 5 tablespoonfuls of alcohol to the water of Electrolytic cell no 1 Coil 1/2 degree less on Carbon needle responds sharper & more readily

290

I now empty 1/2 the alcohol & water out & add to the remainder 2 bottles powerful of chloroform & balance 3 times at 75 exact there is a difference well defined of 3/4 of a degree carbon deflecting it lower - verified this six times - used lense to magnify the scale of galvanometer - seeing one of the leading wires from the Calland nearer the galvanometer than that from the carbon fixed it and made the test again found that it was not a source of error - doubled the amount of chloroform found that perhaps give a little more deflection down the scale - I then threw the carbon out of balance increasing its strength by plugging up 20 ohms this gave 75 1/2 while ~~carbon~~ Calland gave 75 on throwing them through the cell carbon gave the lowest deflection I now add 50 more making 70 in favor carbon by the balance I find that carbon goes to 76 1/2 while Calland remains at 75 - when Calland is put to cell gives 58 carbon 58 1/4 scant with 60 only plugged up on carbon it gave 76 1/4 scant Calland 75

291

with 52 ohms in carbon making it just so much stronger than Calland & giving 76 while Calland gave 75 - putting either through the decomposition cell gave precisely the same deflection. - Nitro-phenic acid in water being possible conductor need only 1/2 inch in 4 oz battery balanced both batteries @ 75 found electrodes polarized rapidly 64 on Calland. 63 1/2 on carbon added little alcohol that makes electrodes polarized rapidly to 58 1/2 carbon 57 1/2 in one minute - Calland 57 1/2 carbon 56 - polarized in one minute to 55 - 53 1/2 in carbon - water & glycerin 1/2 5 1/2 making about 1 1/4 in 4 oz battle - Calland deflection 42 1/2 carbon 40 3/4 with pure glycerine not enough deflection to get a test owing to non sensitiveness of the galvanometer - added a little water ~~when~~ and I got about the same results as in the first instance - Bromine water & water 1 inch in 4 oz battle balanced 75 Calland 63 1/2 - 62 3/4 carbon - again Calland 63 3/4 carbon 63 added a little alcohol, 3/4 of a degree difference - water and sulphuric ether 1/2 inch in battle balanced in favor of Calland it being strongest by a 1/10 of a degree

Calcand through decomposition cell 33 1/2
Carbon 31 3/4 again Calcand 33 carbon
31 1/3 addition of a little bromine water
to above, resistance gradually decreases
diffrence 1/4 degree = added little alcohol
still 1/8 diffrence balance moder 1/8 degree
higher on carbon Calcand 61 Carbon 60 - Benzol &
little water deflection down in the 10s 1/2 degree
lower on carbon than Calcand more Benzol 1/4 deg
diffrence about 1 deg dif =
added Bromine water 71 1/2 Calcand 71 1/4 Carbon
balanced very slightly in favor of Carbon
poured off the Benzol & used it with electrodes
Calcand polarized so rapidly cant test it - its very
little. say 1/2 degree. it goes down scale to
70 - chloride potassium poured in Benzol
so as to form a layer at bottom bitt needle
to 73 - by giving little more strength to carbon
1/8 degree the carbon is weakest through
cell by 1/4 deg - water & caustic potash needle
goes to 72 - diffrence between cal & carb 1/4
degree - bal 1/8 deg favor Carbon yet Carbon
1/4 deg weakest through electrolytes =

293

alcohol solution of potassic Hydrate perhaps
some water got in as deflection is 73. only 1/80 deg
difference in Cal. & Carbon deflections
added to this mercuric nitrate when bal in
favor 1/2 deg of Carbon - could not perceive any
difference between Cal & Carb
Solution of mercuric nitrate balance in favor of
Carbon 1/8 deg Carbon gives 1/8 degree greater
deflection than Calland shewing that mercuric
nitrate conducts equal well with both carbons
for fear that something has altered my
Electrodes I try water again 1 1/2 deg between
Carbon and Calland - same after 3 minutes of
electrification =
Prot. Chloride Saturated Solution offers scarcely
any resistance but by using very small galvanometer
there was a deflection of 1/2 degree Carbon
being that much less conducted. Bal favor
Carbon with plenty Water & Rosemary
Carbon appears to be 1/8 higher than
Calland or slightly more than the bal. in
di water
Rosemary only (perhaps little water got in)
deflected Calland 65. Carbon 64 1/4
addition of small lump Prot. Chloride of Iron
Calland 66 Carbon 65 1/4 -
Addition of same Common acetic acid

294

scarcely any deflection
Either only - 1 Deg. Difference - with Salt 1½
(Balance favoring Carb) When shaken there
is a def ~~[illegible]~~ of 2 Degrees When in the 50's
& 1¼ When in the 60's - addition Acid sends
needle to 76. then ¼ Deg. lower in Carbon
Pure Spts Turpentine - No current, Ground
Hot Copper Electrodes get wet in between
them by the block of hard rubber took
this out so they were entirely seperate -
Glacial Acetic Acid added deflection Only
15 = Carbon Shows ¼ - Deg. less of ¼ = deg.
in favor Carbon & Metal Circuit - added
few drops nitric acid deflection goes to
- Called 48 = Carbon 46 - Stood it well
dif ¾ Deg. Deflection goes up to 63.
adding more nitric acid makes deflection
greater & difference less -
Tartaric acid ¼ in in Bottle - Cleaned
Electrodes (I perceive a little mercury
when clean) 1½ Deg difference Standing at
70. After standing for some time & allowing
the Electrodes to just touch polarizing down
in the 50's then there is 1½ Deg. difference
I find that by screwing the Key close
& making just Contact that the needle falls
1½ Degrees & stops there & on closing
on Carbon it dont go any lower
While if I stop on Called it ~~dont go~~
~~any higher~~ goes 1½ Deg Higher
Carbon the metal resistance
slightly stronger —

295

Bromide of Zinc Saturated very little
Water - & auf - in it - gives deflection 7½ -
Carbon ¼ less than Gallend -
With the very edge of the Electrode touching
goes down in the Hole & there is a difference
of 2 Degrees
Pyro - Oxylic Spirit & little Aniline Oil
Sp. Gr. 1¼ Degrees Clearly defined ¼ in
favor of Carbon On metal resistance
addition ammonia - Hydrate Bring Needle
to 70 & makes diff of only ¼ Deg.

Phenomenon

Oil of vitriol Almonds & Saturated solution
Pots Chloride of Iron well Shaken On closing
On Carbon jumps back ½ Deg. then on
Gallend goes up Sharply 3 Degrees then
On closing on Carbon goes back ½ Deg.
then on closing goes up 3 Deg. still
higher & same way till it creeps up to
65. - from 35. it also acts very funny
in other ways - at 65 makes 1 Deg Diff.
Well Shaken goes to 10.
It appears to go very easy -
By adding more Chloride it goes
to ½. When diff is only ¼ Deg.
I shall now endeavor to make
some Lead Electrodes - Also some
Lead & Tin. Electrodes

Aug 15 1876.
Tal

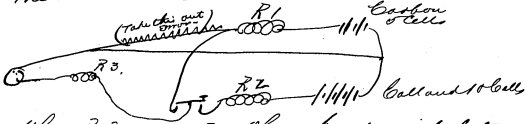
296

We find upon further experimenting that a resistance Coil can be substituted for the Decomposition Cell which gives the same result. but apparently not in as marked a degree as some of the solutions - For Instance -

We find that by the insertion of a Certain resistance - say 500 ohms - of a Rheostat in place of the Decomp. Cell - & by the Manipulation of the Rheostats in the Leading wires from the Battery - a perfect balance Can be obtained on Galvanometer. showing that Currents of the same intensity passes ~~to~~ the Gal. from the Battery. the balance is destroyed when the total Res. is increased or decreased from the point At which a balance was obtained - this is probably due to the difference of the ~~two elements used~~ propelle force of the - For Instance. If upon a 500 ohm Res. including a Gal. upon the insertion of a Carbon Batty a Certain deflection (say 60) is obtained by withdrawing this & substituting a Copper Battery giving the same degree of deflection an opposed Equal current is obtained - but if the Res. of the Ckt. is materially increased it will be found that one or the other Batty (one give several degrees more deflection than the other - In our experiments tried to balance the Carbon & Copper Cells as near as possible by means of the Rheostats in the Leading wires from each Battery but found that a perfect

297

balance could not be obtained - which would hold good for all variations in the Rheostat inserted in place of the Decom. Cell -



When R. 3. was 500 Ohms. by manipulation of R1. + R. 2. a perfect balance could be obtained on Galvanometer when either Battery was placed in circuit (by means of the Key) An increase or decrease in R. 3. destroyed the balance

By inserting the strength of the Copper Cells + shunting them with R1. a perfect bal. of the Batteries was attained - which could not be disturbed by any variation in R3. This balance in 5. mins. however - was disturbed by local action in the Battery re balanced again + in 3 minutes found it out 1 Degree - a 3rd balance at the expiration of 10 mins. left the balance perfect at zero -

By inserting a resistance in the leading wire to Gal. + another in the Decomp. Cell wire + taking the deflection of through the Metal Resistance

298

& of the Decomp. Cell Res. at the same degree of Deflection we are enabled to notice any difference between the Metallic resistance & the liquid resistance, starting with balance in favor of the Metallic.

Using Zinc Electrode

We obtained with the solution named below - the variations of deflection as follows:

Water			Slight Difference	
Alcohol & Nitrate of Lead			No Diff	
Do Tequi Chlorid Iron Crystals			"	"
Do Red aniline			"	"
Do Do line			"	"
Do acetate of mercury			"	" High Resistance
Do Tequi Chlorid of Cromium	No Diff		Heigh Resistance	
Do Blue aniline Potassium	Slight "		"	"
Do Brown Do	No "		"	"
Do Grape Sugar	"	"	Very "	"
Do Starch	"	"	"	"
Do Salicylic acid	"	"	"	"
Do " " " Carbolic Acid	"	"	Low Res.	
Do Sulphate Nitrate Sodium	"	"	"	"
Do Mono. Chloro. Acetic acid	"	"	"	"
Do Castor Oil	"	"	High	"
Do Molybdenic acid	"	"	Low	"
Do Iodide of Potassium	"	"	Very "	"
Do Bromide of Cadmium	"	"	"	"
Do Acetate of Nickel	"	"	Following High	"
Do Tartaric acid	"	"	Very	"
Do Caustic Soda	"	"	" Low	"

Alcohol. Fused Chloride Zinc	20 Dif	Very Low.	Red.
Do Gallic acid	" "	High	"
Bi. Sulph. Carbon. Crystl. Cl.	" "	Insulator	
Alcohol. Chlo. Cl. Bi. Sulph.	" "	Very High	"
Carbon. Pyrogallic acid			
Bi. Sulph. Carb. Chlo. Cl. Phosphor. Hydrate	" "	Extra	"
Alcohol. Cy. of Potassium	" "	Low	"
Do Sul. Chromite ammonium	" "	"	"
Do Nitrate of Uranium	" "	"	"
Do Green aniline	" "	"	"
Do Poto. Chloride of Lime	" "	Very "	"
Do Carbonate of ammonia	" "	"	"
Do Nitrate of Strontia	" "	High	"
Do Chloral Hydrate	" "	"	"
Do Pyro Gallic acid	" "	Very "	"
Do. Gallic Phos. acid. Potassic Phosph	"	Low	"
Do Cuprous Iodide	" "	High	"
Do Nitrate of Zinc	" "	Low	"
Do Hydro. Phosphate of Ammonia	" "	"	"
Water. Salt. Solute	" "		
Oil Sweet almonds. modiflu	" "	Insulator	
Water Acetic acid Solute	" "	Low	Red.
Common Acetic Acid - Modiflu		Very "	"
Oil Sweet Almonds. Liquid. Chloride Zinc	" "	Dark Extra	"
Water, Liquid Chlo. Iron Solute	" "	"	"
Oil Rosemary Concentrated Sol.	" "	Insulator	
Glacial acetic acid	" "	Very High	Red.
Phenomenon { Decreases red. of the Current		by Increased Pressure	
Oil Sweet almonds Bromine	" "	Insulator	
Oil Rosemary Bromine	" "	Do	
Oil Rosemary Iodine	" "	Do	
Oil Sweet Almonds Iodine	" "	Do	

300

Spts. Turpentine Iodine. No Diff. Insulator
Oil Rosemary Crude Potash. " " Nearly an "
Phenomenon { needle goes 5 Degrees, then to 2, then up 1, making sudden fluctuation
Defeat for special Experiment

Ammonia Hydrate Strong No Diff. Very Low. Res.
Water Ammonia Hydrate Dilute " " Moderate " "
Oxygen Gas acid. Turpentine " " Very High "
Phenomenon { Shaking makes it an Insulator

Spts Turpentine Cy. Potass. " " Insulator
" " Chloroform " "
" " Iodide of Potassium " "
" " Creosote " "
" " Carbolic acid - " " Very High Res.
" " Sulph. Ether " " Insulator
" " Fuming Nitric acid " "
Phenomenon { 1st Immersion shows zero - then suddenly to 25 - to N. to 30 to 20 then to 25 - Sudden & Violent fluctuations of 15 Degrees at over - Standing quiet near 20 Deg. Shaking relapses (No Diff)

Spts. Turpentine. Bi Sulph. Calcium No Diff. Insulator
" " Glacial acetic acid. " " Dry
Slight Conducting When Shaken
" " Hyp. Sulph. Soda. " " Very Slight Current
" " Bi Sulph. Carbon " "
+ Glacial acetic acid - } Insulator
Slight Current Decreases on "Shaking"
Spts Turpentine. Bi Sulph. Carbon } Dry
+ Iodide of Potassium "
Spts Turpentine Creosote + } " " Dry
Fuming nitric acid
Bi Sulph. Carbon Cy. of Potassium } Dry
+ Iodine " "

301

Bi. Sulph. Carbon. & Benzole No Def. Insulator
Spts Turpentine Hydro. Chloric acid
Pneumonia { Hydro Chloric acid collect at Battery - Electrodes often touching & an Ammeter } " " No Res.
Bi. Sulph. Carbon. Iodine } " " Very High "
Alt Hydrochloric acid.
Bi. Sulph. Carb. Glacial acetic acid " " "
Spts Turpentine. Bi. Sulph. Carb. Iodine " " Insulator
Oil Methane Iodine. " " Low Res.
Bi. Sulph. Carbon. Caustic Potash " " Insulator
Bi. Sulph. Carbon. Saturated Sol. Sesqui Chloride Iron.
Pneumonia { Sesqui Chl. Iron Drops & Battery - Electrodes often touching Carbon rods - Close current on very high Res. Low Res. when Stoppered } No Def.
Bi. Sulph. Carbon. Oil Rosemary No Def. Insulator
Oil Methane Sesqui Chloride Iron Crystals No Def. Low Res.
Bi. Sulph. Carbon. Sesqui Chlor. Iron. No Def. Insulator
Bi. Sulph. " Oil Methane " " "
Oil Methane - Glacial acetic acid - " " Very High Res.
Oil Methane Spts Turpentine " " Insulator
Oil Rosemary Sesqui. Chloride Iron Crystals " " "
Benzine Glacial acetic acid. " " Very High Res.
Oil Sweet almonds. Oil Methane " " Insulator
Glacial acetic acid. Ether " " "
Benzine Iodine " " "
Bi. Sulph. Carb. Benzine. Oil Methane " " "
Alcohol Oil Methane Chloride Iodine Crystals = Vapor when chicken " " Low Res.
Alcohol Bi Sulph. Carb. Caustic Potash " " Very " "
" Camphor Glacial acetic acid " " High "
Oil Lavender Glacial acetic acid " " Insulator
Alcohol. Benzine & Caustic Potash " " Very Low "
End of Spirit tests

302

Lead. & Tin. Electrodes — Aug 6=76

Water - Gradually Dec. in Res. No. Dif. - Low Res.
Water. Caustic Potash. " " " "
Oil Turpentine Hydro Chloric acid " "
" When shaken Res. largely increased -
Sudden closing of Cct. Cotton flower on
falling of Hy. Chl. acid to bottom. " "
Bi. Sulph. Carbon Creosote — " " Insulator
Bi Sulph Carbon Iodine Hydro
Chloric acid - Very Variable & Wavy " "
Bi Sulph Carbon Glacial acetic acid
Lead attacked violently by Glac. Ac. acid. " "
Oil Turpentine Creosote & Fuming nit. acids. " Insulator
Went up slowly to 2 degrees - Lead attacked
Oil Turpentine Bi Sulph Carbon -
Iodide of Potassium — " " Insulator
Bi Sulph. Carbon. Cyanide of Potassium
and Iodine " " do
Oil Turpentine - Iodine - think I see a dif.
Oil Sweet almonds & Iodine No Dif. Insulator
Oil Rosemary Creosote " " "
Water Liq. Chloride Iron Dilut " " Low Res.
Oil Turpentine, Hydro. Sulph. Iod. " " Very High "
" " Glac. acetic acid " " Insulator
Oil Turpentine Fuming nitric acid. " " Insulator
" " Bi Sulph. Carbon " " Mod. Hi. Res.
" " Sulph - Ether " " Insulator
" " Carbonic acid. " " "
Alcohol Oxalic acid " " Mod. Res.
" Fused Chloride Zinc " " Very Low Res.
" Caustic Soda " " " " "
" Tartaric acid " " — " "
Oil Turpentine Creosote " "

303

It is evident that the phenomena so far recorded is nothing more than a destruction of balance & Electromotive force of Battery. Nothing apparently in it =

Aug 7 1896 —

Electromatograph

We have just got our new paper writer functioned & works totally well.

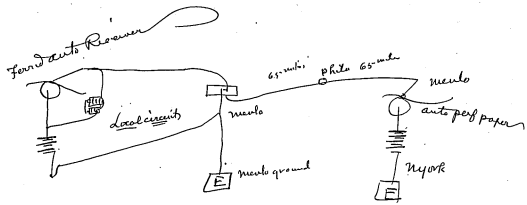
Have wet some pyrogallic paper Ferrideyanide of Potassium dilute & some of the Electromatograph paper of Metals of Mercury & Corrosive Potash =

We are going to attempt repeating through the Phila Loop. Connecting in the manner shown in the diagram

over

Wilhelm Aug 7 1896

304

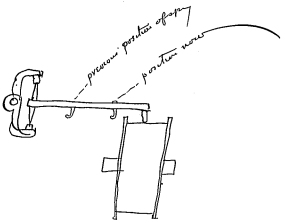


Perhaps we shall have to shunt the EMG with a magnet, also to use a plain resistance shunt at Transmitting end. Even perhaps we will a magnet in the said shunt =

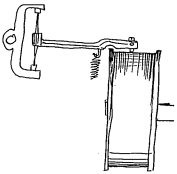
We have made a slight alteration in the method of putting on the springs on the lever of the EMG. In all previous Experiments we have put springs near to fulcrum thereby increasing the friction in its pivots, we have now put the springs ~~weak~~ nearer the Extremity of the lever reducing the friction on pivots & making a much better adjustment =

Wednesday Aug 7 1876

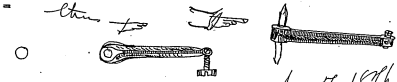
305



I think ~~that the~~ lever should be arranged thus

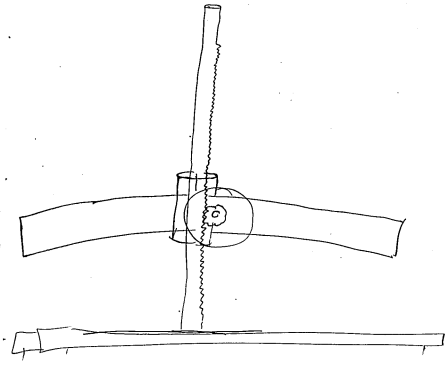


The point wants to be near edge of lever so there shall be no twist = The lever should also be made with ribs =



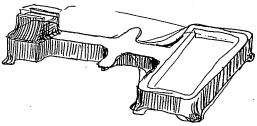
Aug 1 1876
Zoldow

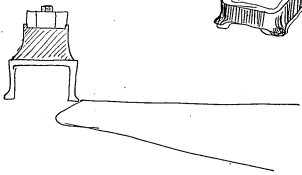
306

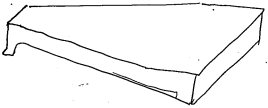


Rack Motion for Mirror Galvanometer.
to raise deviating Magnet up & down
Easily

Aug 7 1878
J Atkinson





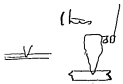


308

Electromatographs

Aug 7 + 8 1876

Fried E.M.G. had great trouble in getting anything at all through it even on short current, had point fine ⊽ this it dug in paper so deep upon pulling on pressure that it couldnt go back to point freely



We tried various papers (1st) pyro - acetate Ag & found but couldnt get anything that would stay adjusted for a second = We then flattened point the ⊽ when we could get it sometimes on ~~so~~ found & fairly on pyro =
After adjusting it on various ways we put great pressure

309

(10)

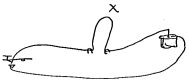
on pyro + open shunt ckt ~~got~~
1600 ohm got it good at 200,
when immediately put on phila
loop when we got it equally as
well at same speed, used 600 plain
shunt at harmonizing and
90 cells Cullard =
no shunt at receiving end
Sample at 200 words per
minute saved for scrap.
Book + well be on this date =
We after wards tried Alcohol &
Sol of Sodic Hydrate,
but results negative =
Got shape words either on
P or O. apparently equally
as well = We now try
1/2 pyro sol + 1/2 glycerine.

310

August 9 1896

Phenomenona

Last night I noticed something that I never saw before and is probably due to the action between the Battery Current & the Earth Current or magnetism



If with one cell of battery connected as shewn a portion of the wire is made into a loop as X either 1 or 2 feet high it will be deflected to one side on closing and by closing the key at the proper time with it vibrating time the loop can be made to attain a large swing 2 metres or more no matter how you place

311

the loop North South East or West
it will dip one way but if you
reverse the current it will
dip the other way.
I took great care that the
vibration of the key did not effect
this I held the key in the hand
with flexible cords. I also
took care that the wires were so
run that there were no parallel
wire whereby the loop could be
affected had them several
feet away. adding 100 ohms
killed the swing apparently.
By further experimenting found
that all other currents the
various commutating wires free
to swing were set in motion
slowly by opening & closing
the circuit.

312

Electromalagraph

August 9. 1876

Last night we had the most successful of all experiments with the EM.9 = Worked it through Phila Loop with 90 cell - first class without a false dot & perfect at 300 words per minute & it did not change its adjustment whether we went at 20 or 300 per minute also run to 600 per minute & got it good but occasionally there would be no breaks between a dash & dot. Shunted EM.9 with 1 spool of a WU 120 ohm relay & sending shunt 600 plain found that whole WU relay was not as good as 1/2 thus shunted the lever moved with great force at 300 so you

313

could ~~so~~ hear every det but of course Conduct read =
These results were attained by the use of a very strong solution of acetate of mercury, reduced to metallic state by Caustic Potash = the solution made night before was allowed to boil weak, we made a paint up pretty close = I remark here that a successful EMG paper must have an initial lubrication to prevent false vibrations & that is the reason why pyro — Caustic Soda — Sulphate Soda & acetate Hg or metallic Hg gave best results, because these are themselves lubricating material, We also found that with the acetate solution & at 300 per minute we had a considerable range of adjustment

314

We used considerable pressure.
Afterward tried it on a loop
to Albany & back 380 miles.
~~that~~ worked very fairly at 100,
pressure. Thought we had
two small batteries added =
30 cells Carbon making 1 Bat & 1 Bat
150 cells Calland = this
added improved
ment improved
it = ~~we got~~ put Will Relay in
series shunt didn't improve
much - Varied shunt = ~~it~~
~~was~~ Came 6 am when we
quit = are having lever
differed for Comm'ty =
& are in meantime trying
to wet paper with a Hg
Sol & letting roll dry &
are writing with a
reducing agent so as to
reduce the Hg to Metallic state
in paper which not mechanically
as previously ——— Aug 9 1876 Toledo

315

~~Slide~~ Electromedigraph

Evening of the 9th =
= 1st time used kind didn't appear cure any of the cuts
Split some patent leather soaked it
was 1/32 inch thick made a band
soaked it well in Carbolic & Acetate
of Hg Solution, put it on EM 9 & it
worked finely 300 words per minute
on philo loop =
afterwards it broke where it was
joined together, we then wet
some Acetate Hg ~~[illegible]~~ loop with
Carbolic. it didn't work, replaced
some of the roll used night before
containing a 1% solution & mechanical mixture
of Acetate Hg with 120. which
had become quite dry. EM 9 wkd
well. then took Acetate Hg (only) roll
placed it in a sol of Prot Chloride. This
reduced Hg to metallic state,
tried it on EM 9. it didn't worked
(replaced old roll wkd well). then we
took another similar roll
put it in Carbolic K ← to reduce Hg

316

+ that didnt work. we then made a Solution free from Mechanically mixed Acetate Hg. and put in KO, & wet paper alarming well in paper matter, This didnt work we dried a little paper + the wk belt but not good, We then made a Sol of Acetate Hg with some of the Sol mechanically mixed like the original Sol, + put in KO; This didnt work well in fact. it didnt work at all unless almost dried. We then Come to the Conclusion that Too much Caustic potash was used, However when we make some more paper a minimum quantity of KO + considerable quantity of Acetate Hg is to be used We are out of the latter today.

While using the ~~what~~ paper

317

left over from last night. We found that we could ~~[illegible]~~ repeat 300 permanent perfect, we could get perhaps 1000 if we had a good EMG because some of the words Ripple at that speed were perfect, We tried it direct, got at 17 wpm at 1000 words. We then mounted on line ~~[illegible]~~ 4 sheets on a Phelps Condenser. This wiped the Crump Entirely out & a chal auto pom. Showed nothing at all at any speed; We then mounted EMG when it repeated 300 perfect, & perhaps better than when in direct & hunted with a mag. This shows that the EMG is infinitely more sensitive than any sensitive Chemical pap

We had to mount 75 sheets of Condenser to get it readable on direct =

318

~~Forgot~~

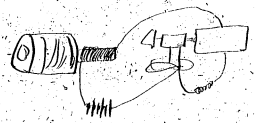
Phenomenona

We have noticed (Gill) that oil of Mustard softens + semi dissolves Hard Rubber.

It also gets under the finger nail painfully the end of the finger + separates in few hours the nail from the flesh so that you can see air space under neath the nail.

It does not touch Ivory = or bone or rather horn = at least not the form in 36 hours; + the latter in 3 hours;

319


4

320 Vol 8
Blake Edison
Oct 9, 1880

321 Vol 8
Blake E
Oct 9 - 1880

322 Vol 8
Blake E
Oct 9. 1888

[PHOTOCOPY]

Ej. J.S. EXHIBIT. 320-8.

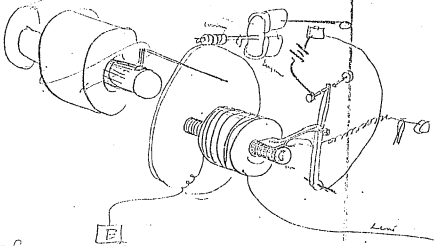
(Edison's Electromotograph Relay Aug 1879)

320-8.

C.L.G.

An idea

The idea has occurred to me that the EMG principle might be applied to an electro magnet. I took a Magnet Exhausted one coil by placing an armature upon it & by opening & closing the Key & passing along a flattened arm wire, the current produced by the friction caused by magnetization and demagnetization was apparent. I purpose to embody this principle in a machine as shown thus



[E]

Of course this is using current ~~[illegible]~~ but equally like the principle of the EMG

[PHOTOCOPY]

EDISON
EXHIBIT. 321-B.

working by difference of function, its the
example of increasing delicacy of
magnetic relays by working in a dual
circuit, when the end of the armature
is has a ring of wrong of-current
electrons to prevent the effect of
residual magnetism it will be
seen that the power with which
relay lever moves is always the
same; no addition or accumulation
of current [illegible] the adjustment
first-the prime, the dynamo
old in magnetic telegraphy
in electro mechanics

(Edison's Electromotographic Rely Aug. 1876)
T. A. E.

321-B

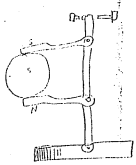
321

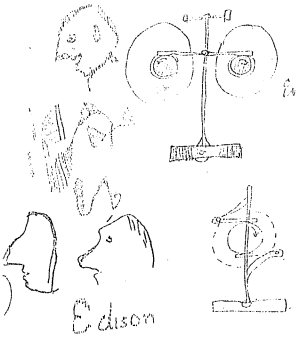
[PHOTOCOPY]

EDISONS EXHIBIT. 322-B.

322 - B

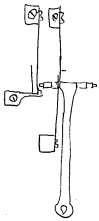
("Edisons Electromotograph Relay, Ca. 1876")
S. L. G.

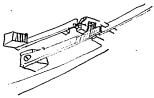


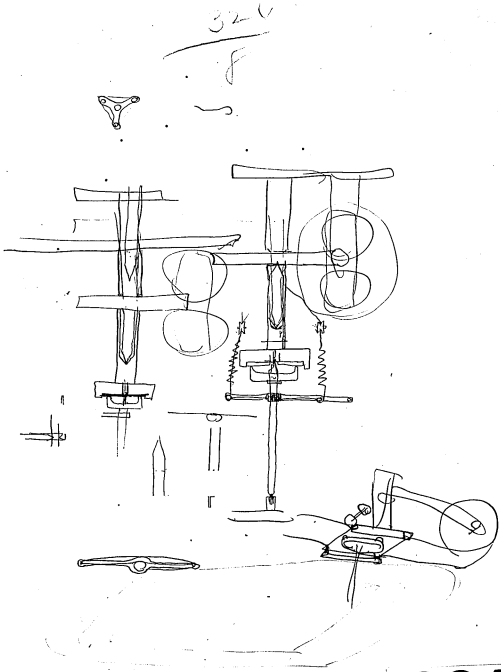


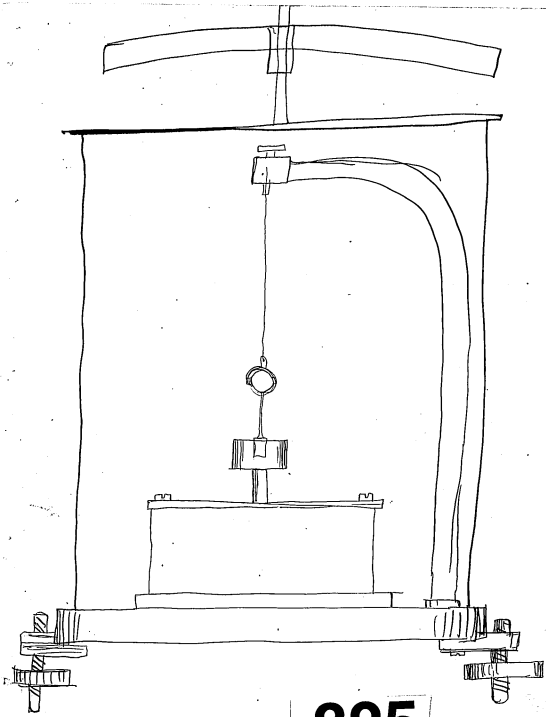
322

323
8









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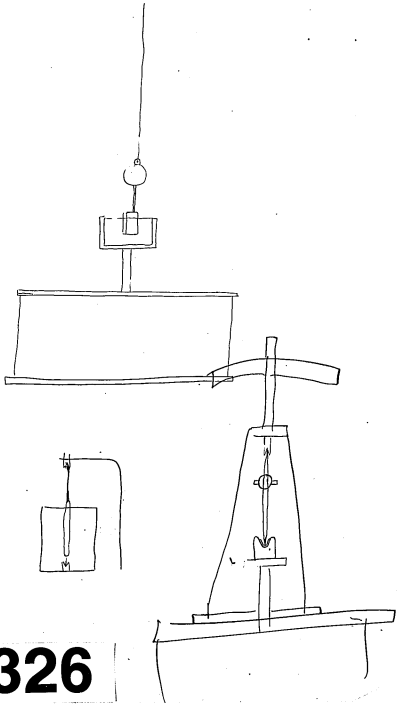

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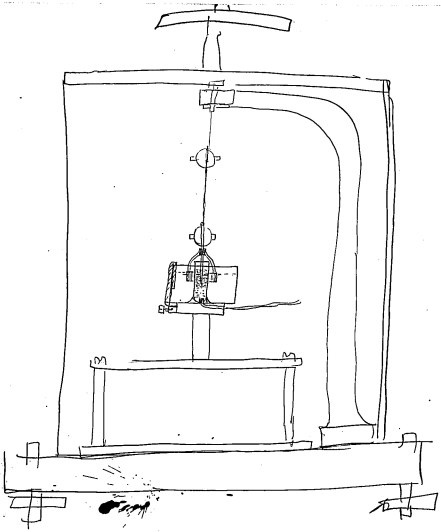
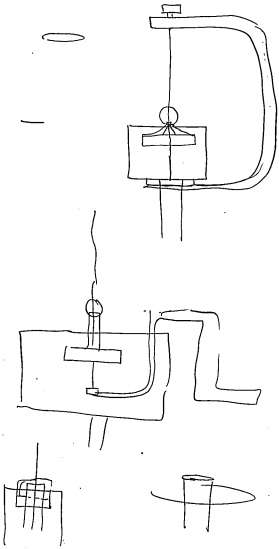


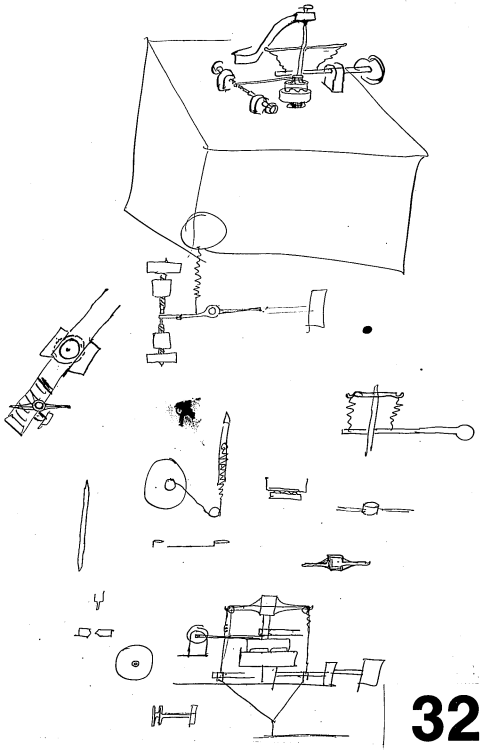
Electrolytometer

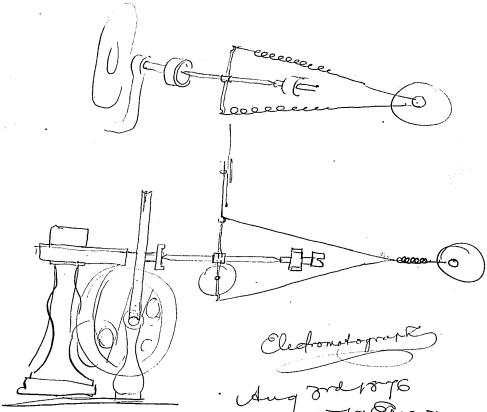
Efe

Chemical galvanometer

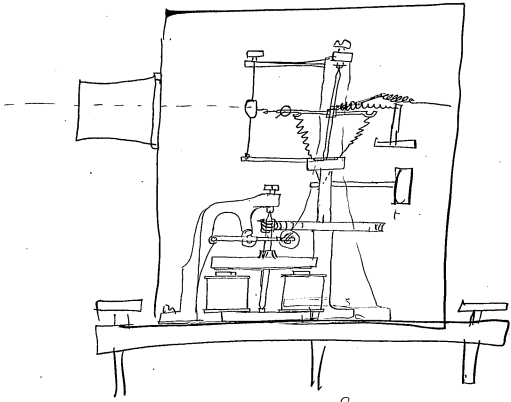
327






Electromotograph
Aug 3rd 1876
T A Edison
Thos A Edison
James Adams

330



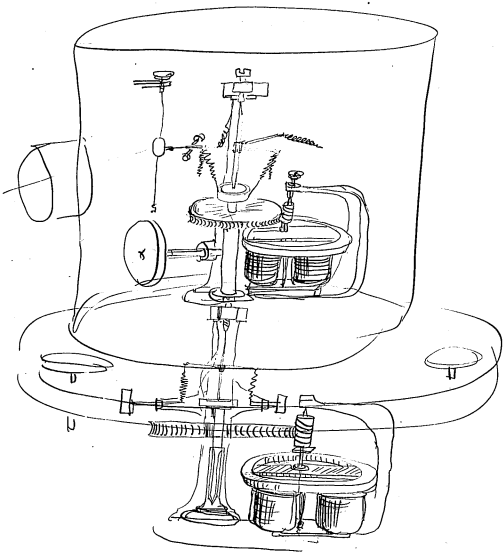
Electromotograph

Aug 3 1896

TAE

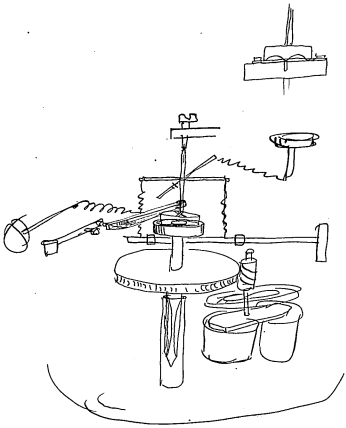
James Adams

331

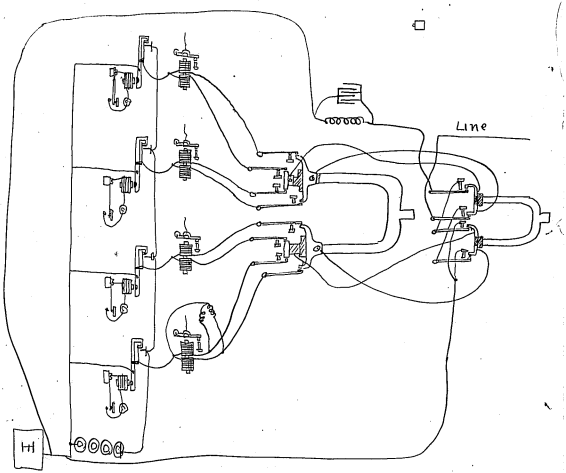


Delicate Electromotograph
Aug 3rd 1876
J. A. Edison

332

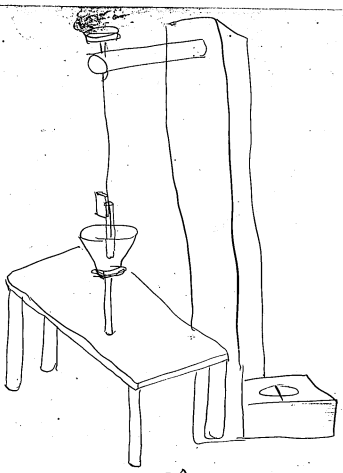


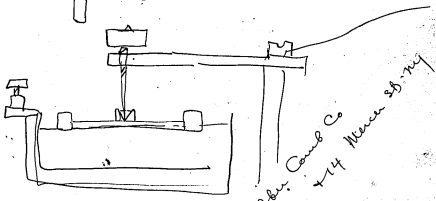
Witnessed by
[illegible]
Aug 3rd 1876



Aug 3rd 1876 Acoustic Transfer
Fred Gatchright on Duplexed making
Phila Coop Co 8 messages on one wire
[illegible]

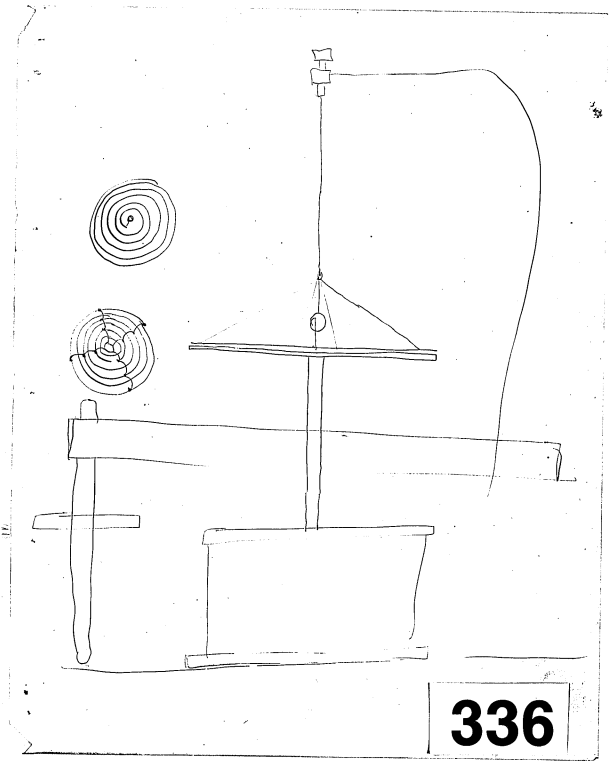
334



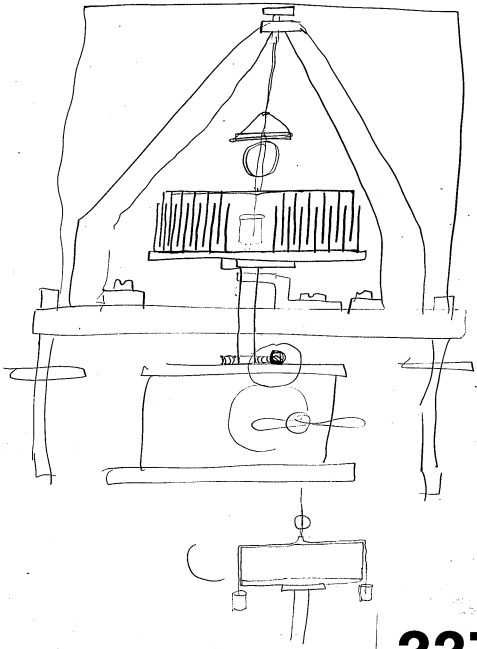


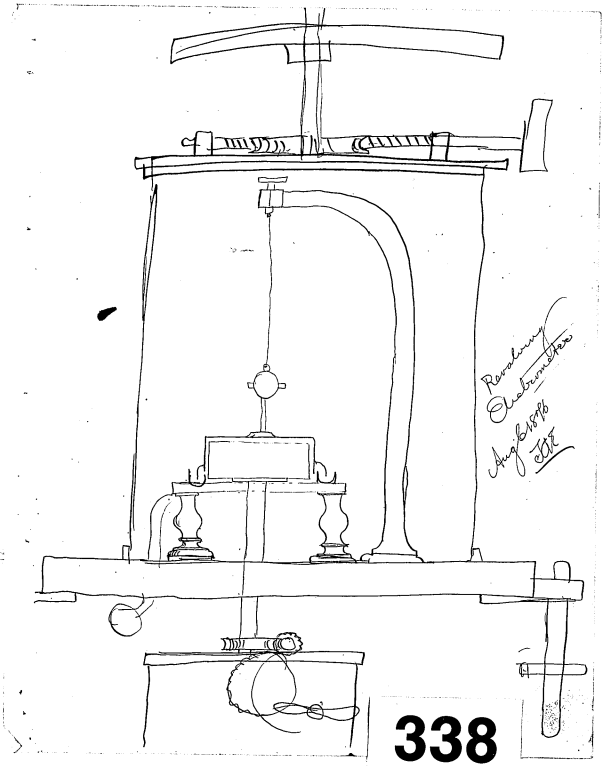
Indian Rubber Comb Co
9 11 + 14 Mercer St. N.Y.

335



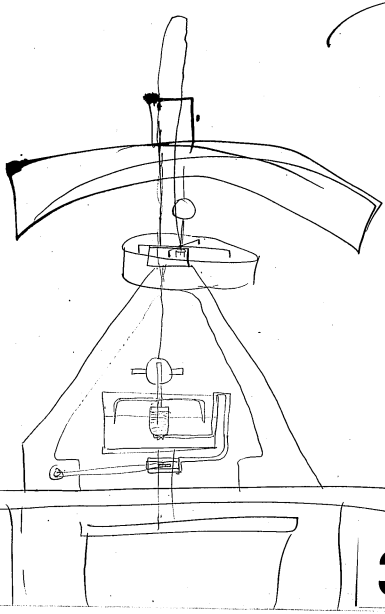
336





338

Chemical Galvanometer
Aug 6 1876
T A Edison



339

Transcsactions of the Chemical Society

Bottomsmen Power
Power
twenty thousand
fourthousand eighty

Bathantine: air
Ale
Aigf
Aibe

Cibbe
Cabril
Cabil
Cabgf
Cabiff
Cabilfe
Cabule
Cabulf
Cabulfe
Cabungf
C

Electromalograph

August 10..

Circuit from Menlo to Boston & return 600 miles, We tried auto direct with 86 Collard +30 carbon – sending shunt low & all send if way – also shunt at receiving station, + best compensation, Sample 1. shews direct writing at 35, words per minute. ~~We~~ after much trying to get it better we inserted E.M.G. with quite dry acetate Hg + KO, poor some word on night of 8th = We got several words direct without shunting E.M.G. tried same on auto wet on local = wether mounted a Phelps Cender 40 sheets at E.M.G. with shunt of ~~600~~ 600 ohm at transmitting end no magnet No 2 is result at 75 words per minute. No 3 shews it without sending shunt same speed = with 32 sheet Sample 4 shews it at 200 words per minute

Sample 5 100 words minute 4 sheets Cond

341

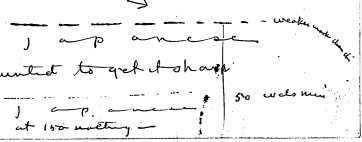
6 all the Condensers probably had bad adjustment -

No 7 on loop from Menlo to Phila thence to Boston + Return to Menlo 700 miles at 125 words per min 40 sheet Condr at recg station in line, + without sending shunt -

These experiments confirm those made last winter on the artificial Buffalo Ckt — do —

No 8 16 sheet 100 w minute - great pressure - 700 miles

With 2½ lb to gal ~~paper~~ Iodide Pot paper ~~the~~ with starch the most sensitive can make. Can get it by shunting at recg end with magnet so as to record it at 50 to 75 thou



no sending ohmit, by disconnecting
magnetic compensation & weakening Cards
at recy end no sending ohmit. 4 sheet ohmit
show a dot 16 nothing 32 nothing
40 just came so that maximum of a dash
would show. 90 sheet got it
40 words. Thus unsounding ohmit
with it get nothing readish owing to weakening
of the J. cap amplifier

it was much faster than this,
yet the EMG on 16 sheets
with very dry paper affording of
itself high resistance repeated
some words perfectly at 200 words
per minute. see sample 1 2 3 4
, 5 6, 7 8

Closed 5 am

T A Edison
Adm
Johnson

343

Hand Motograph

Continuation of experiment of Aug 4, 5 or 6th with the High resi flunds through 70,000 ohms 6 cells Carbon with pen engine indicating a Reciprocating sounder + key to stop + start vibrations,

Best Standard on test was I believe,
Alcohol + Nitrate of Uranium,

I now get the adjustment so to speak of the delicacy of the best solution yet found (14) the above, standard =

70,000 ohms standard good

Alcohol- Cupric Chloride not up to Standard
" Oxalate Cerium as good as that

Better than standard on H with Tin + Zinc only a tri best,

Alcohol Lactate Zinc not up to Standard,

Can feel it only on Silver = H,
zincate plumb = prbly not so good as standard

344

Alcohol + Sandalwood,
apparently ~~marked~~ friction on skin (very
drying) strong. Phenomenal.

Alcohol + Valerianate of Zinc. I think I feel it

Alcohol + Acetate Manganese.
Best compare with 4 Standard 5 Atelan.
pressure was very strong

Alcohol + Acetate Cobalt Phenom
not good as Em. 9 but when they open
feel as if dots came or you were
drawing pen along as on a 1000 ruling
there is a great sense of friction =

Alcohol + Protochl Tin can just feel it
when normally wet great normal friction

Alcohol + Acetate Lime - just feel =
Alcohol + Ammoniac Tears - doubtful if feeling
" Iodide Hg - "

Alcohol & Cadmium Chloride = Phenomena

with very light pressure & on tip get the dot faintly
with great pressure & very flat of platinum
get a great deal of friction on closing
key - but not sharp feel like the charge &
discharge of a Cable =

Alcohol & Benzoate ammonia just feel with pressure
apparently get dots when sounder lower down
(repeat back point) and these dots are apparently
increased by on its repeating on air
Can't be ~~that~~ ~~these~~ these
are residual vibrations or after vibrations

Alcohol & Cuban Trichloride = doubtful if feel

Alcohol & Gum Sandarac Doubtful if feel.
Do & Sulphite of Ammonia " "
Do & Chloride " Nickel Just Feel if -
Do & Nitrate " Magnesia 1st Class. Need is not little
than No. 5 Standard
Note Compare = Shows best
on tin - Worst Stand heavy
Pressure -

Do & Bi-chloride of Mercury
On N. apparently increases
friction with Nickel -

a book

"Iodide of Iron apparently get nothing
Do & Sulpho Carb. Sodo. Doubtful if feel -
Do & Iodide of ~~Potassium~~ - As good as 5 Standard
On aluminum nickel & zinc
Weak point

346

Phenomenon! Aug 12-1876

Exceedingly plain & sharp on Lead!

When point is used - Dont show well

When flat is used -

Use of Sulphate of Aniline - nothing -

Do & Salicine nothing

Do & Iodide of Lead - Just feel it

Do & Cocoa Butter Feel it quite plain when fresh

Try this in some other menstrum

Do & Gum Benzoine Apparently nothing

Do & Grape Sugar Nothing

Do & Acetate - - - - - Nothing

Do & Chloride of Potash - - Nothing

Do & Lactate Acid - - - - - Nothing

Do & Butter of Antimony - Nothing

Do & Sulphate - - - Quite plain on Copper only

Do & Lactate of Bismuth - Nothing

Do & Chloride of Lime Nothing

Do & Formate of Soda - probably better than the Standard on Lead - Sharp - light Pressure - Even when paper wet dry

C!

Do & Shellac - Feel it slightly

Do & Gum Hemlock nothing

~~Dot~~ Mirbane & Flower of Soda - Just feel Paper Blacks Iron & Copper probably a sulphide

Iodid of Potassium & Water - Nothing

Neats Foot Oil & Turpentine Nothing

Oil Sassafras - alcohol - & Rum Nothing

347

Aug 12th 1876

Cocoa Butter & Water —

Phenomenon!

Quite strong - but prominent on Oxygen with Aluminum light pressure

This working on Oxygen may be attributable to changing the menstrum -

Co. Butter - rubbed on Paper with Water
Nothing on Hydrogen -
Friction increased quite strong on Oxygen with Aluminum - Others not so apparent —

Do. Do. Heavier Buttering -
Too much of a good thing - Delicacy decreased —

Do Do with Salt for Conductivity
No Improvement

Edison

348

Menlo Aug 17th 1876 –

Electro Motograph.

Experimenting on different Porous substances to replace Paper in the Essay. –

Found Black Lead – very absorbant – Lump Blk Lead – Pyro Gallic solution – Good results – but difficult to keep moist – admits too free passage of current – dont give time for decom. of solution – Gets soft on surface – Powdered & rubbed on metal gives better results.

Chalk & Pyro Gallic –

As good as Paper – Good conductor, at same time admits of Motograph action Holding solution well – Chalk not being of itself a conductor – allows the solution to perform that function alone –

349

Licorice & Pyro Gallic -
Licorice kept & rubbed on the Drum
- when, nearly dry is quite good

Note If is Evident the Electro Motive
Action - is due entirely to the
Solution - & only requires a
Solid, to hold it.

Cork - Pyro Gallic.
Pyro Gallic on surface gives
Conductivity - but no E.M.F. action

Gum Tragacanth - Pyro Gallic
No result - Except Conductivity

Grape Sugar - Pyro Gallic -
No Good

Sal. Ammoniac - Pyro Gallic
No Good

Soap Stone - Pyro Gallic
Made into Paste - No Good

350

Carbonate of Ammonia. Pyro Gallic
Work well with good Pressure
- but dissolves quickly in the solution

Borax - Pyro Gallic -
"Afraid its a failure"?

Camphor - Pyro Gallic -
Sticks

Note - It continues to be apparent
that Surface Conduction dont
give E.M.G. action - The action
would seem to be direct through
the substance

Paste of Paris Pyro Gallic
thin layer - mixed with Pyro Gallic
Excellent
Good Conductor. Good E.M.G. action

Pine Wood. Pyro Gallic
Very good – Will try again
When more thoroughly wet.

Tried it again – about Same

Chalk is Best so far

Edison

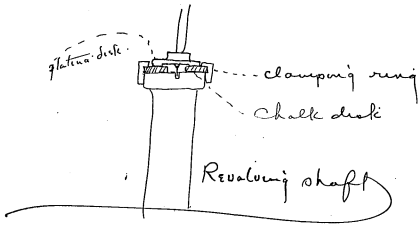
August 18 1876.

Electromagnetic =

Have been making a large number of Compounds of Iodides of Pan HO & other things such as Phosphate of Iron, Chalk, Litharge Etc to ascertain whether the best substance to make strokes off for the ~~work~~ E.M.G. We having ascertained that. the action is entirely due to the decomposition of the fluid

352

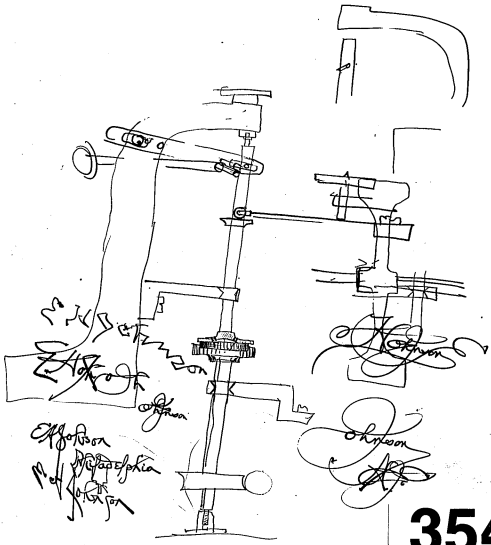
These will not be dry ~~f~~ until Tomorrow = Had to with fix the Ebb from a three point tripod (which was a failure owing to want of proper substance ~~f~~ would be solution) to a disk, thus

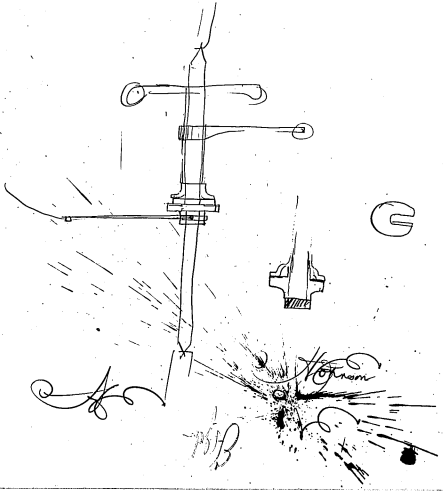


We put on a washer turned from Natural Chalk, which had hardly been wet (with pyrogallic), when we found that the Mechanical Vibrating action had Ceased and that apparently one of the main abutments had been removed = by

Remarcatining. and increasing friction spring found that it

Repeated at about 100. per min 5000 ohm 20 cell battery perfect




A
B
C
Nothem

EMq Aug 18 1896.

With the new EMq & Chalk pyroqallic we recd hundreds of volts over loop to Phila = at rate of 200 per minute Very not perfect notwithstanding that the shaft run out, We are going to have the shafts all put in clockwork Centers to get rid of shake.

August 21 1896 -

Experiment with EMq Solution holding & Solution;
2 cells old Carbon 20000 ohm; Carbonic Soda best - Phila
Pyro & Can K not so good as
Soda = Alcohol & Nitrate Urin

356

fair = fearful measure fraction in O,

Kaolin no good on NaOH or pyro,

plaster not good =

1 Chalk & Glycerine 20 grm 100 ! O - no good on 40 000 ohms.

2 Chalk & 5 grm ~~[illegible]~~ Shellac 1 grm KO, 100 cc C_2H_5O, no good =

3 5 grm Balsam Tolu. 1 grm KO - mix

4 Phosphate P. & Acetate Hg in solution one good = paper soaked in NaO, no better - ~~[illegible]~~

We now test with 60 000 ohm Metallic & 1 small Water R ~~[illegible]~~ with 1 cell old Carbon = Carbon Jar in Chalk gives it weak but plain. I standardize this = & Canadian Company also other hand with a paper I have on EMG.

357

4 = Acetate Nickel 10 gm 100 cc H_2O
not up to standard feel nothing
on the 60000 ratio Rheostat 1 cell.

I now go back to 60000 ohm as my standard pair appears to weaken.

5 ~~Acetate~~ Manganate of Soda 20 gm 100 cc H_2O N.G.

6 Iodide Pot. ~~PT~~ Chalk dont feel

Citrate of Potash, + Plaster dont feel on H but friction greatly increased on O, and this friction is apparently stronger than like. Can Soda slip on H on my standard pair it appears to act rather quicker than the general run of measured friction

7. Iodide Iron 20 gm 100 cc H_2O, ~~not~~ dont feel anything

358

8 Acetate Uranium 14 grains - not fully =

Phosphate KO. 20 grains 100 cc H2O N.G.

20 grains Tartrate Soda N.G.

found that ~~add to~~ my old slantard
pain weekend off - found
two bottles reversed solution
in bottle when it came off on
60000 obs. which I now use

100 ccs.
1 grain Glycerotrione - N.G. ~~H2O~~

No 10 -

20 grains Arsenate of Soda
100 CC H2O - - - - - N.G.

No 11 -

40 grains. G. of Potassium 100 cc H2O.
No 12 N. G.

48 grains Ferrid G. Potassi 100 cc H2O
N.G.

No 13. Metallic Sodium laid on Empty Platina Pan Drawn across it N.G.
Platina Pan fastened to Sodium & Dr Drawn over Standard Caustic Soda Piece — N.G.
Took a little Mercury - Put it in Shallow dish - put Sodium Piece in it - result - quite a devil's Agitation on the Surface of the Mercury — Short Circuited the one cell — put one Pole in the mercury - Touched the other to the Sodium When there was an Instantaneous Explosion - the major part of the whole becoming a tough Solid substance — N.G.

No 14 20 Grams. Potassic Hydrate 100 cc H.O. N.G.

No 15 = 20 Gr. Chromate Soda - 100 c.c. H.O. N.G.

16. 10 G. Tannic Acid - 100 cc H.O. N.G.

17. 40 Grams. Nitrate Strontia 100 cc H.O. Poor -

18. Nitrate Magnesia Alcohol - Excellent

19. Sulphate Cobt. Amis. 100 cc H.O. - N.G.

360

20 1 Gr. Mor. of Lead - 100 cc H.O. N. G.
21 Gelate of Cerium Alcohol - N. G.
22. Formate of Soda - Do - N. G.
23. Nitro Prusside Soda 100 cc H.O. T. G.

Note Caustic Soda - Standard Piece

On Oxygen 1st closure no other Immediate friction Not disappearing for several seconds - Date cannot be felt - After Pen has ceased discharge Cell may be Broken, & closed again without any change having taken place - It appears to roughen the Platinum =

24. 1 Gr Aloin - 100 cc H.O. N. G.
25 1 " Pyro Gallic. 100 cc H.O. N. G.
26. 20 " Sulphate of Indigo. 100 cc H.O. - N. G.
27. 20 " Permanganate of Sodium 100 cc H.O. - N. G.
28. Concentrated Solution - Pyro. & Caustic Soda - N. G.
29. Nitric Acid - - - - - - N. G.
30. Tungstate of Soda. Water - - - - - N. G.
31 " & Caustic Soda " Tried again - when dry - quite good N. G.
32. 40 Gr. Glycerine & Salt - - - - N. G.

Note Caustic Soda -

By taking advantage of decrease of friction on Oxygen - in using reverse Current - I get splendid action - because the normal friction is largely increased by the action of the Current

33. 1 qr. Valerianate Magnesia 100 c.c. H.O. N. G.

Note Plaster Paris. 3rd Caustic Soda. N. G. But it may when Dry - will try again

Edison

Exactly

Experiments to determine the best proportion of Caustic Soda with Water for delicacy & sharpness & power.

362

New Form. Gravity Batty.
Aug. 22d/76 —

No 1 —

Glass Jar - Carbon sing
Zinc - Small Wt Gravity
Carbon - Powder'd about 1/4 Pint
Sulph Copper (Blue Stone) - 1 lb —
10 Ann Marks 6 oz —

363

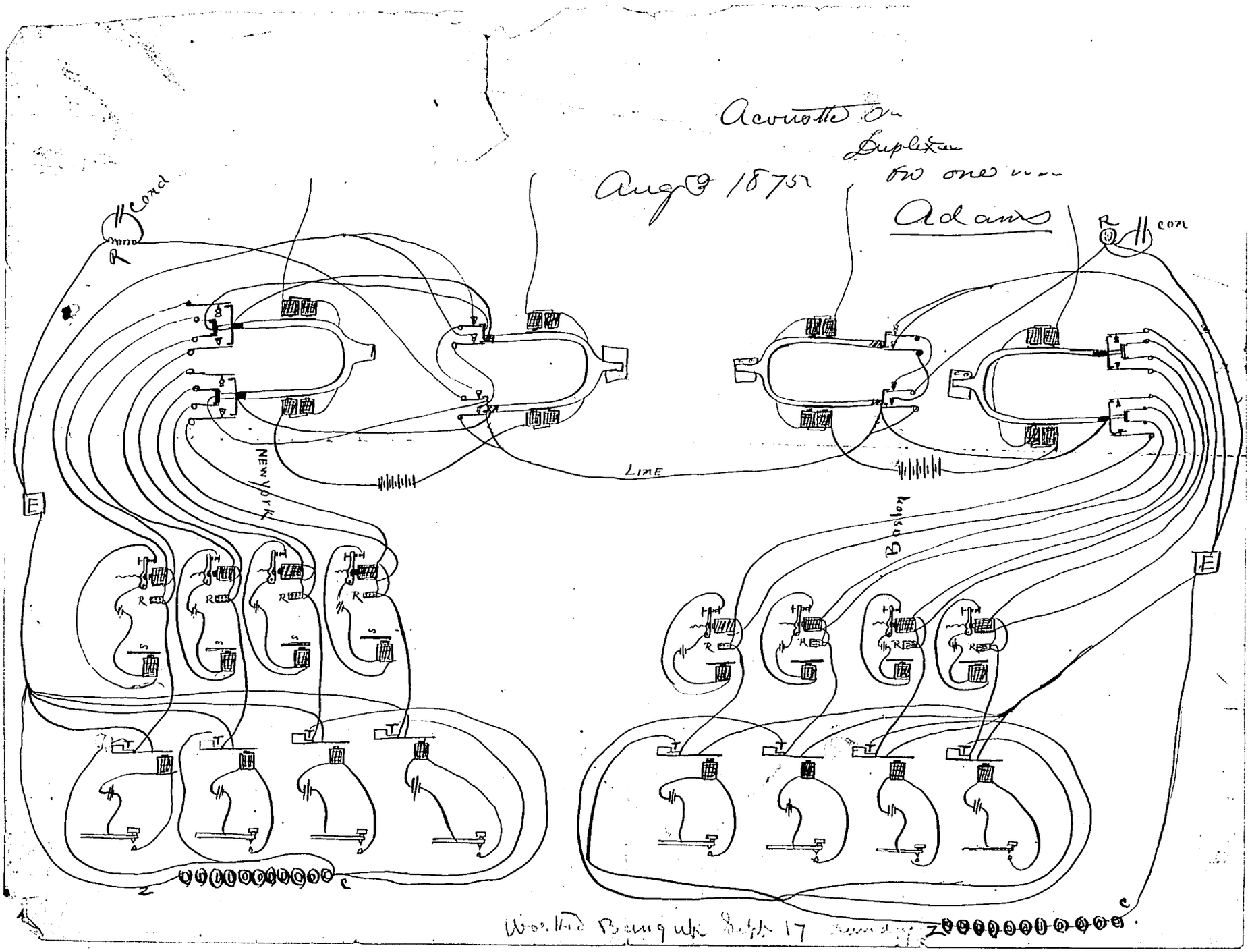
Notebook, Volume 9

This volume covers the period August-December 1875. The notes and drawings are by Edison and Charles Batchelor, and the names of James Adams and Edward H. Johnson occasionally appear as witnesses. Most of the material relates to acoustic telegraphy. There are also notes and drawings of etheric force experiments and a drawing of a pen for an autographic telegraph. The volume consists of 23 numbered, unbound leaves, many of which appear to have been removed from a scrapbook. Some of the pages in Scrapbook Fragment, Cat. 30,100 (Miscellaneous Shop and Laboratory Notebooks) were probably also removed from the same scrapbook.

Missing pages, found in facsimile in the Telephone Interferences: 6-10, 17.

Missing pages: 1-2, 4, 14-16.

THE REDUCTION RATIO FOR THIS DOCUMENT IS 16:1


Acoustic Or
Duplex
for one wire
Aug 8 1875
Adams
Cond
R
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E
New York
Line
Boston
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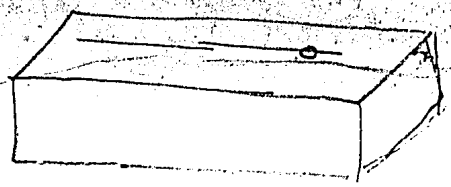
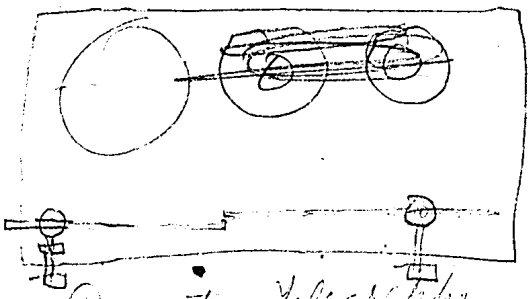
Z
C

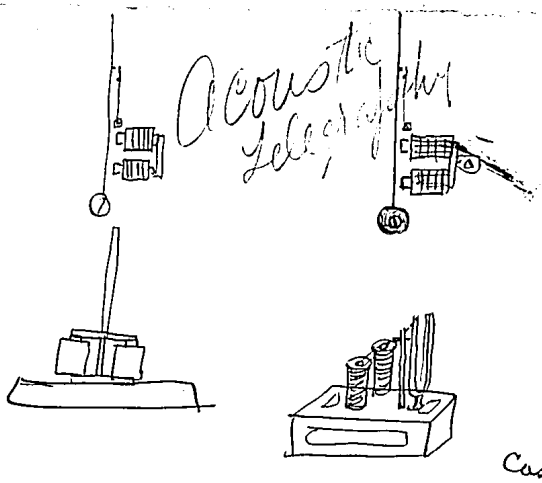
T A Edison





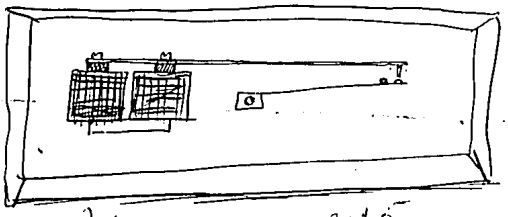
Acoustic Telegraphy
Nov 15 1875
Bartlett

Acoustic Telegraphy



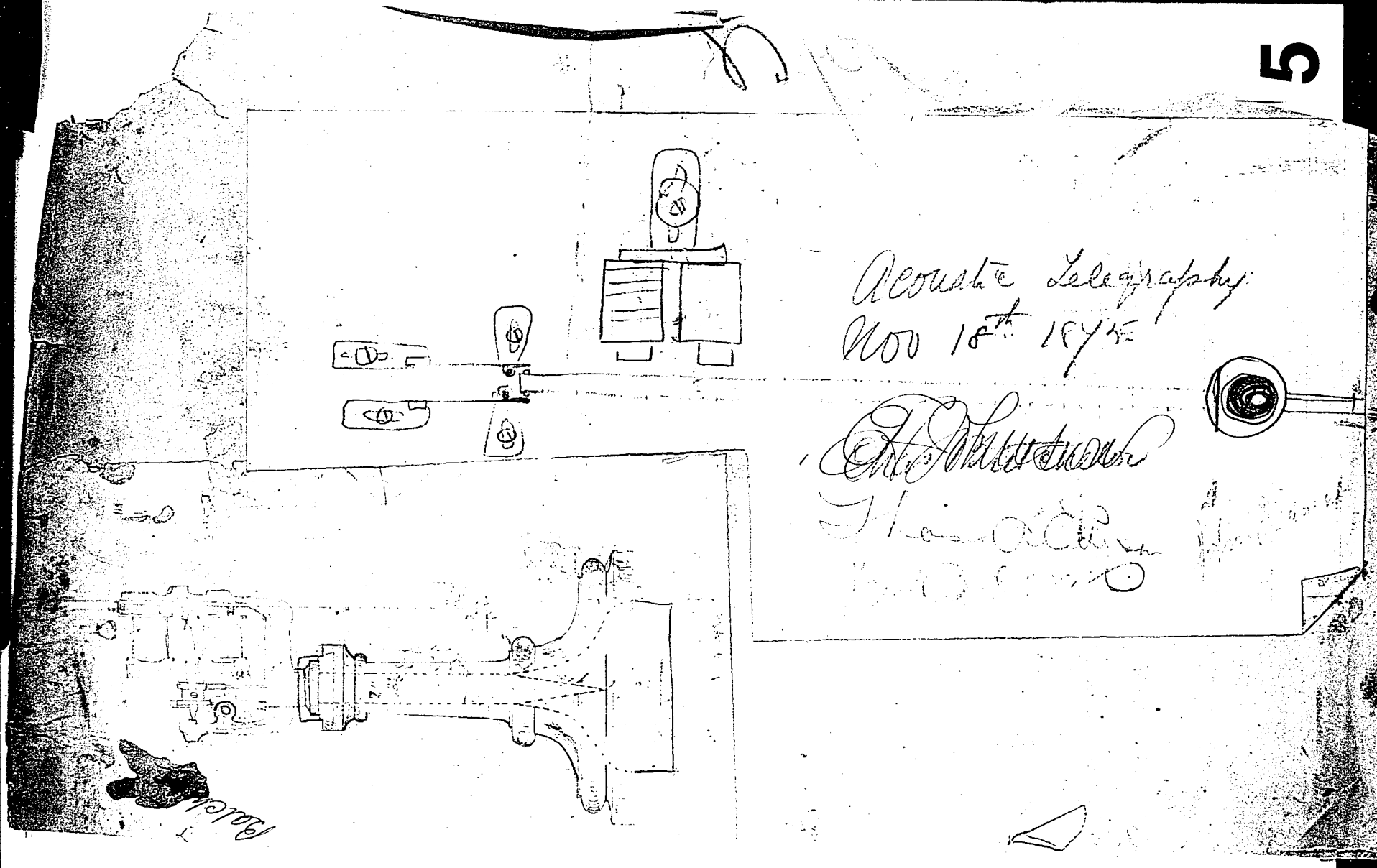
T A Edison

Case 118 Exhibit D.



Nov 12 1875
Bartlett

5

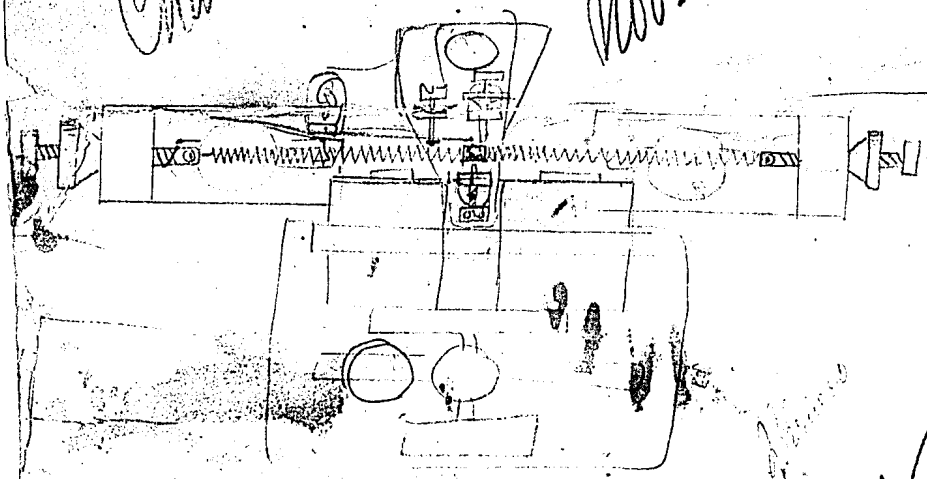

Acoustic Telegraphy
Nov 18th 1875

9/9 Un Ser 8 x 9 870

Pel

Sen Interference

Chas Balstein Nov 21st 1875

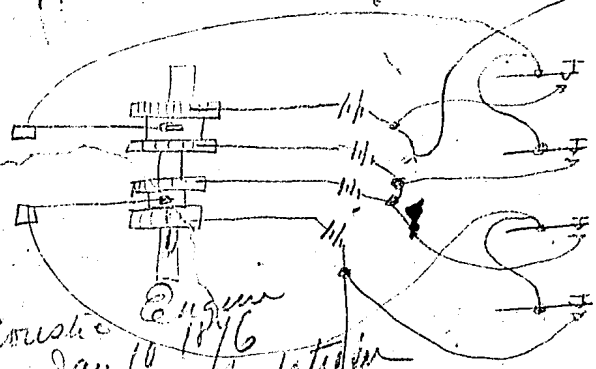


Turns	176	22	teeth	44
"	220	27	" 4 out	54
	264	33	" 3 out	66
	330	41	" 2 out	82

8 Revolutions per second

480 Revolutions per minute

of bar per double the [illegible]



Witness
Jan 10 1876
Chas Balstein

11

Exhibit A

D. Electric Force

Page 1

Fig 1

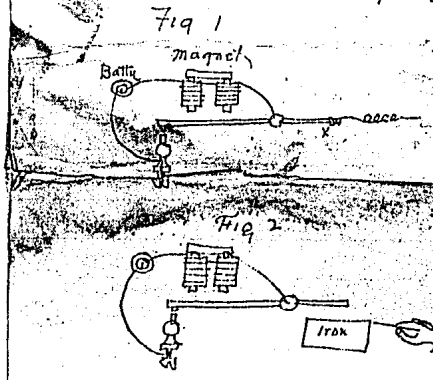


Fig 9

Fig 10

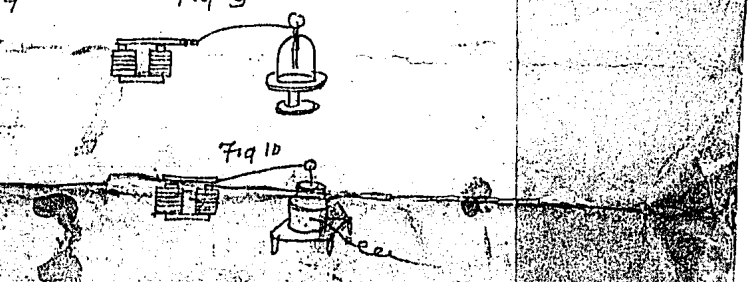


Fig 2

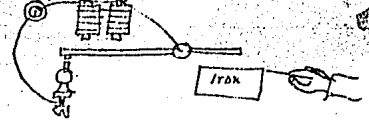
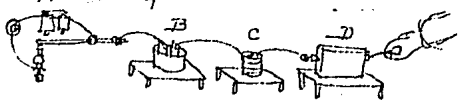


Fig 3



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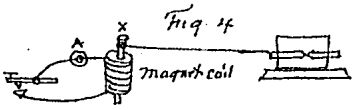


X copper core

Fig 5

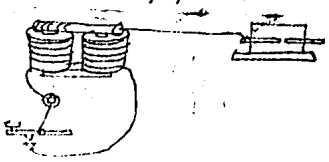


Fig 6

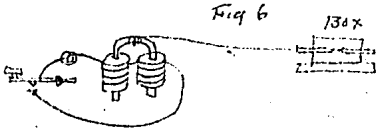
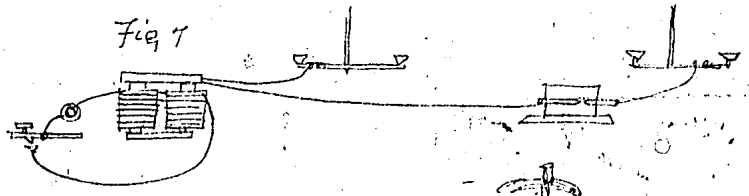


Fig 7



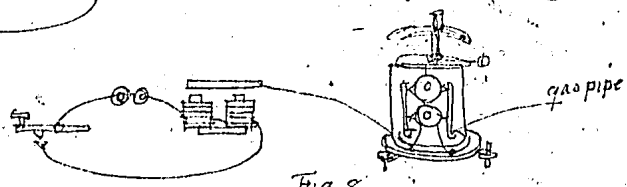
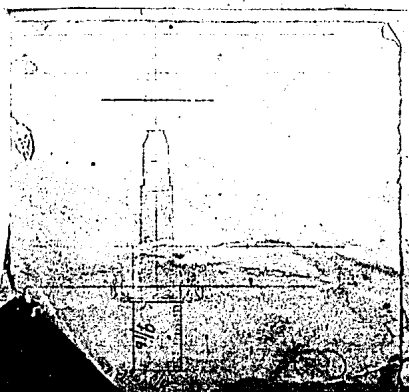
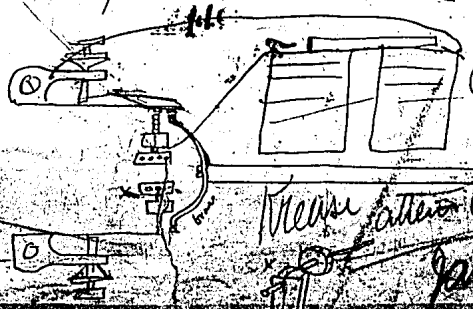


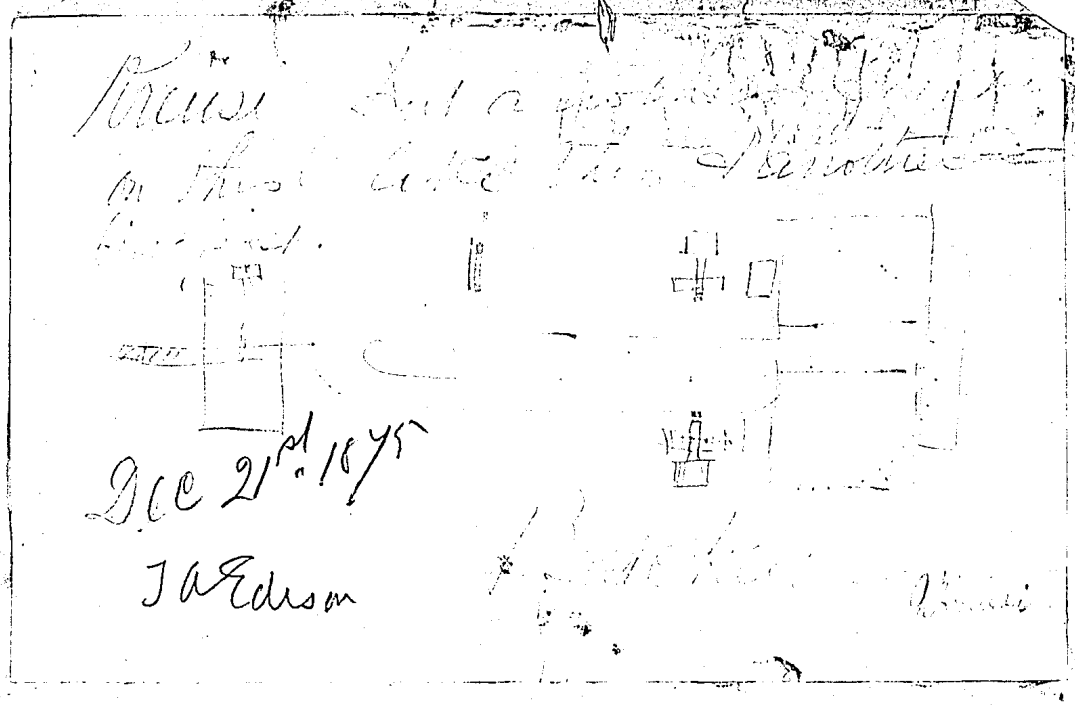
Fig 8

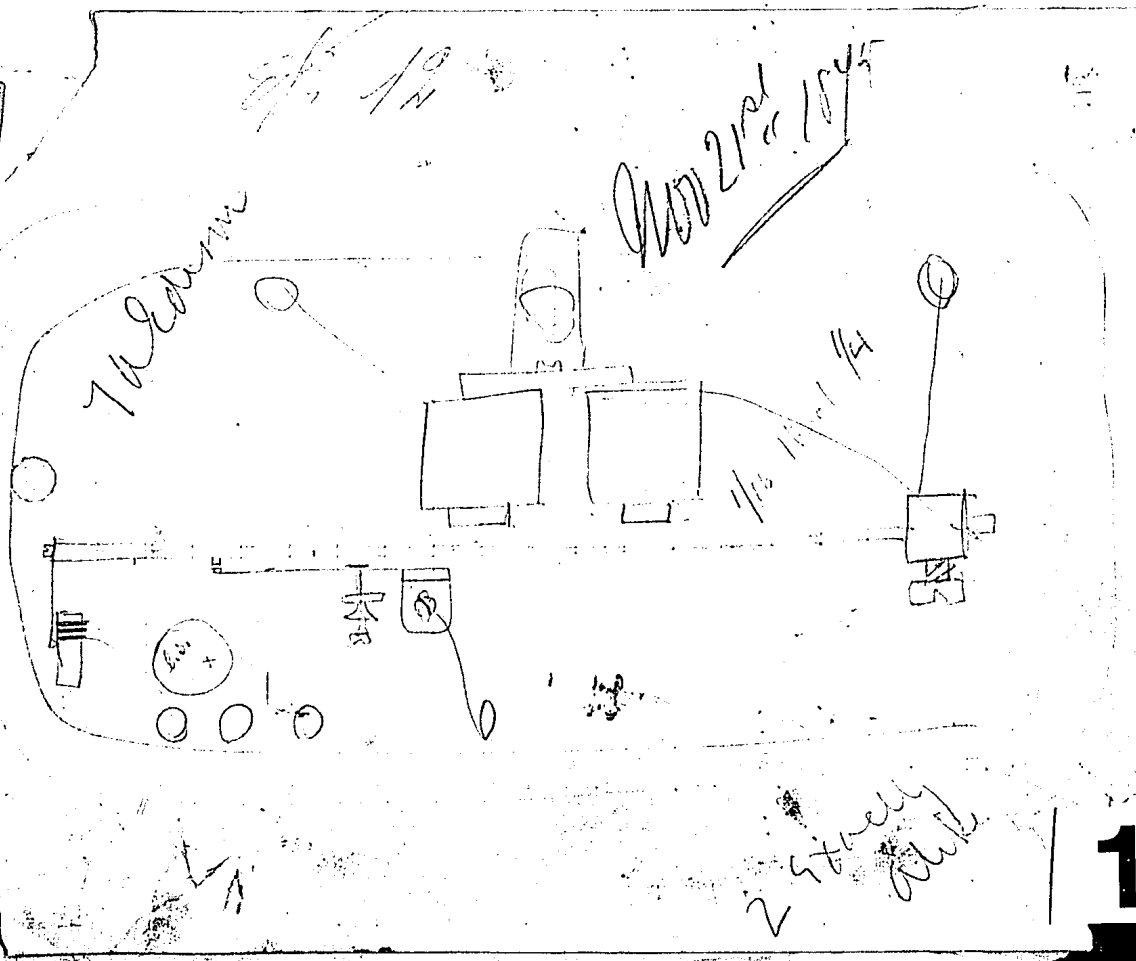
11



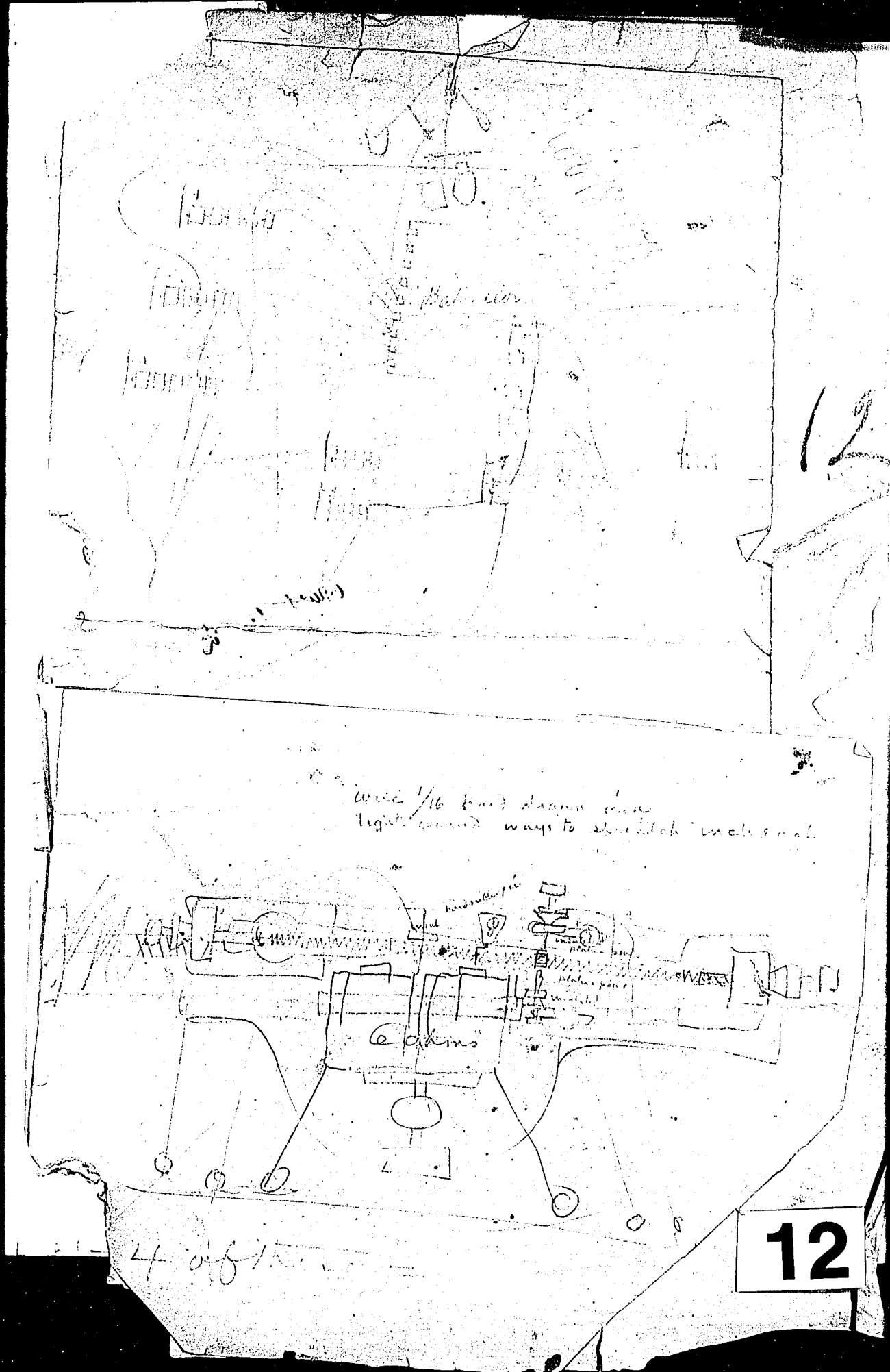
Batch have been altered for convenient thus way (Transmitter)







12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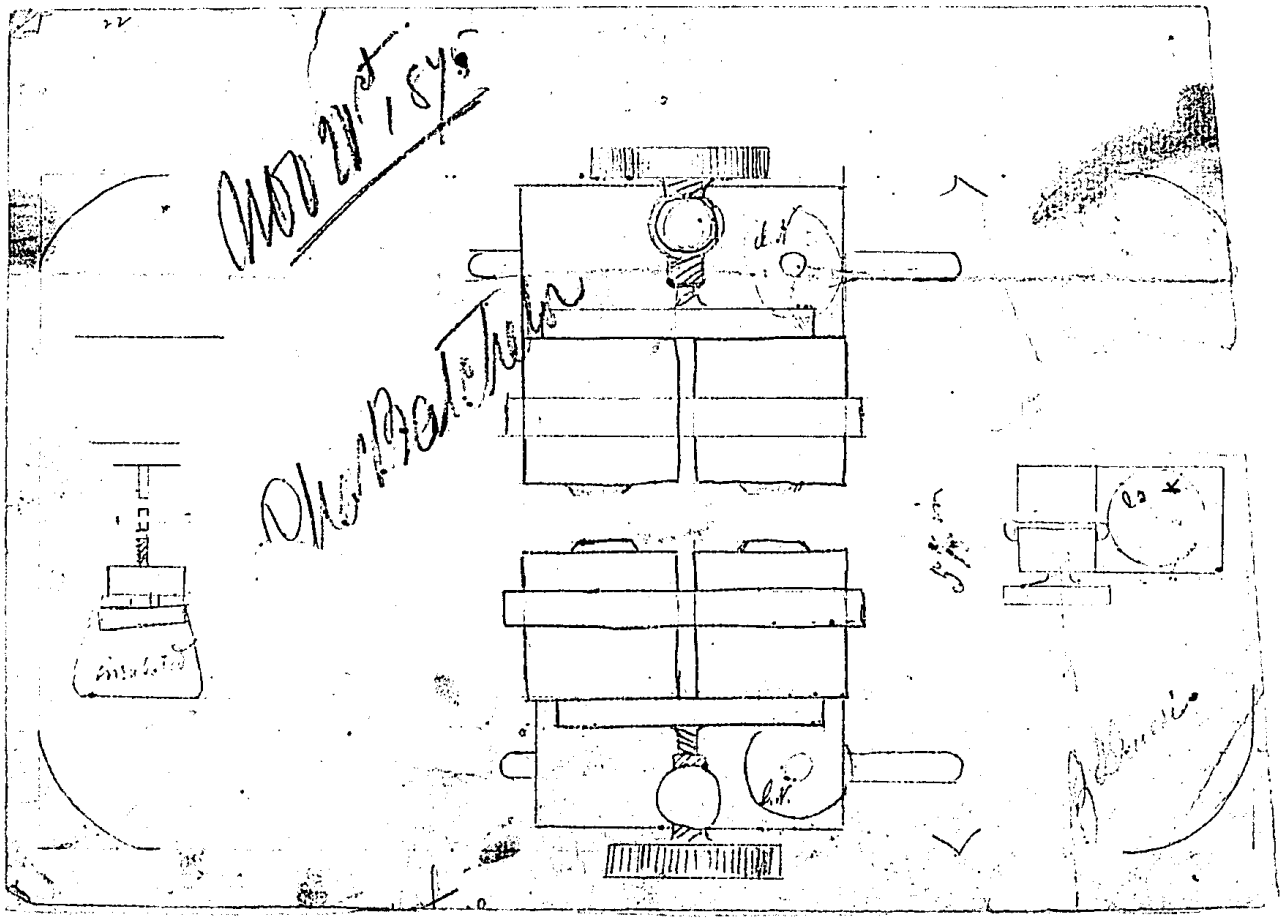

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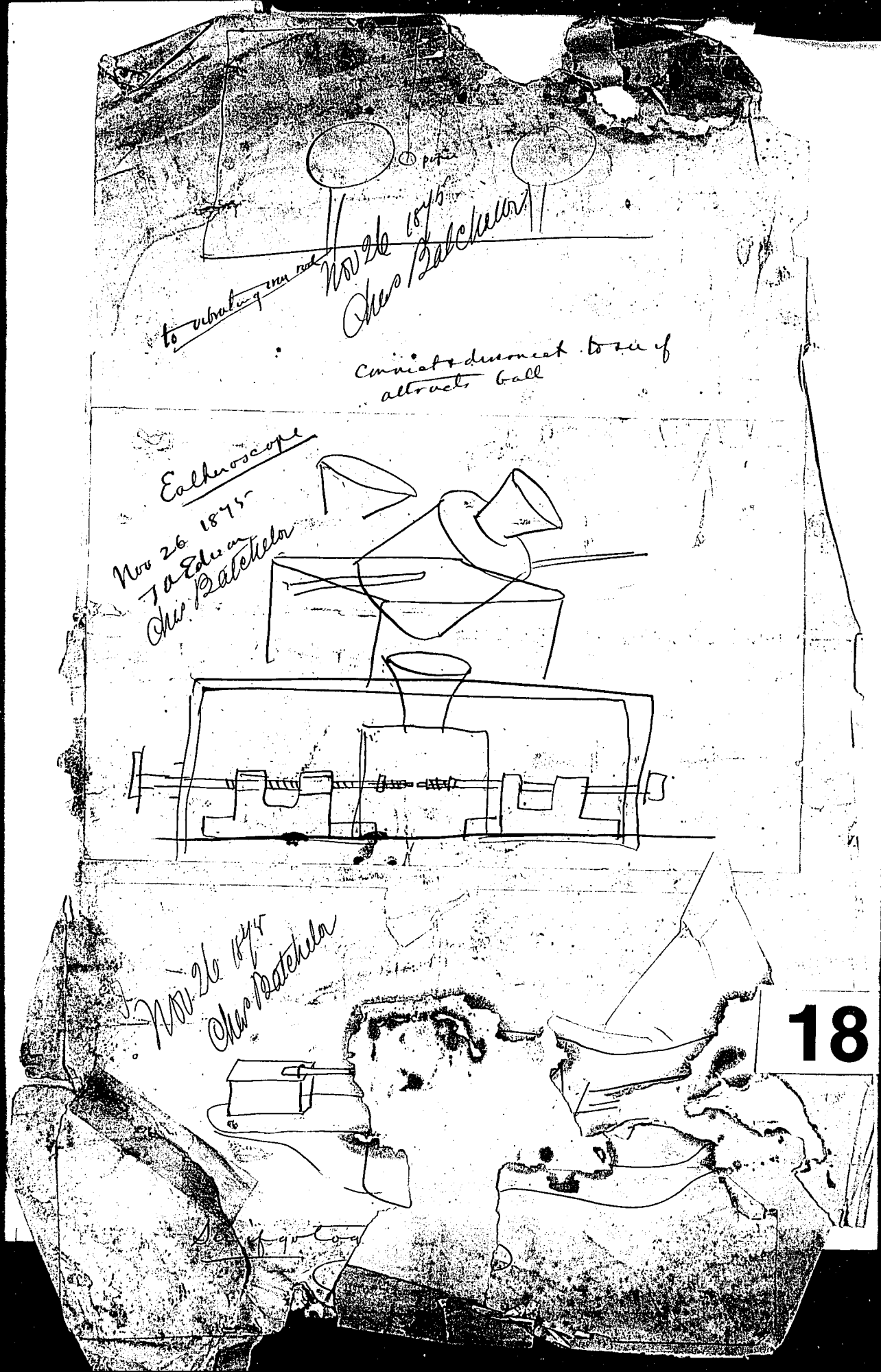
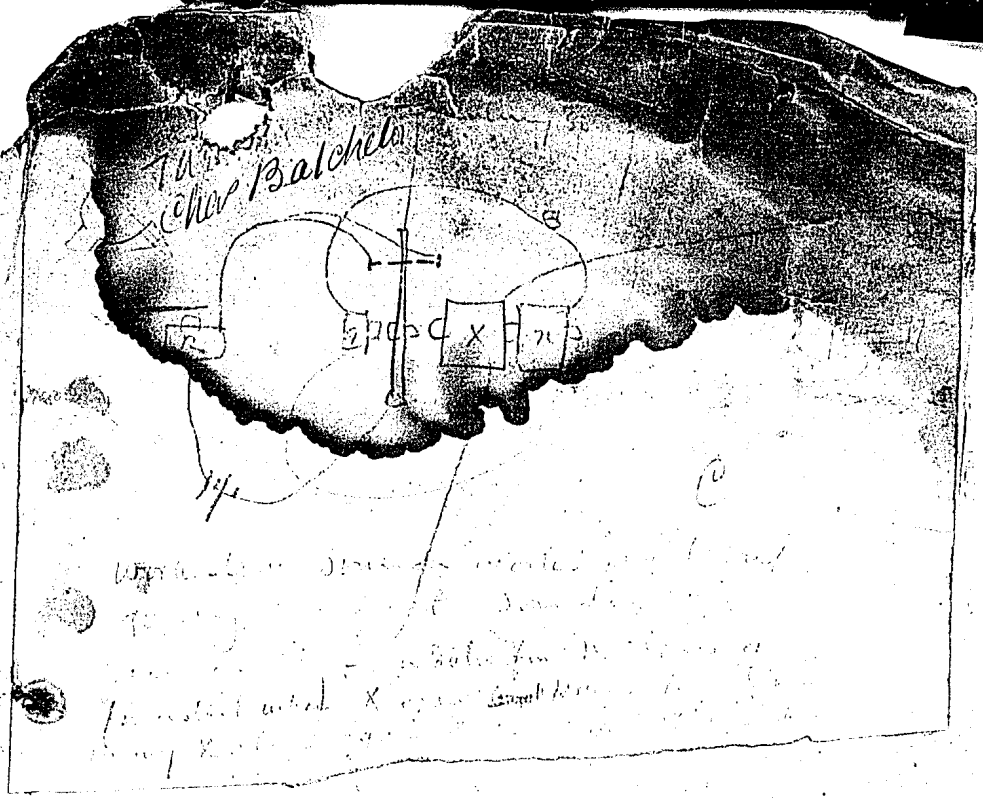
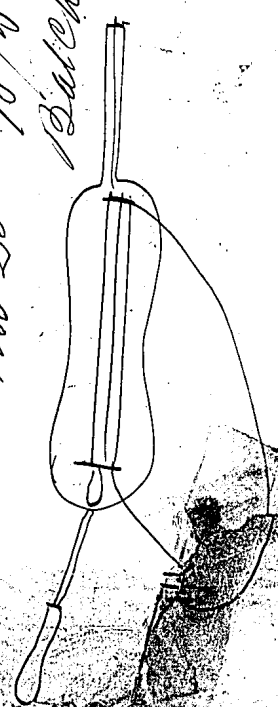

Nov 26 1845
Chas Batchelor
to vibrate a iron rod
Connect & disconnect to use of attract Ball
Eolhroscope
Nov 26 1845
To Edison
Chas Batchelor
Nov 26 1845
Chas Batchelor



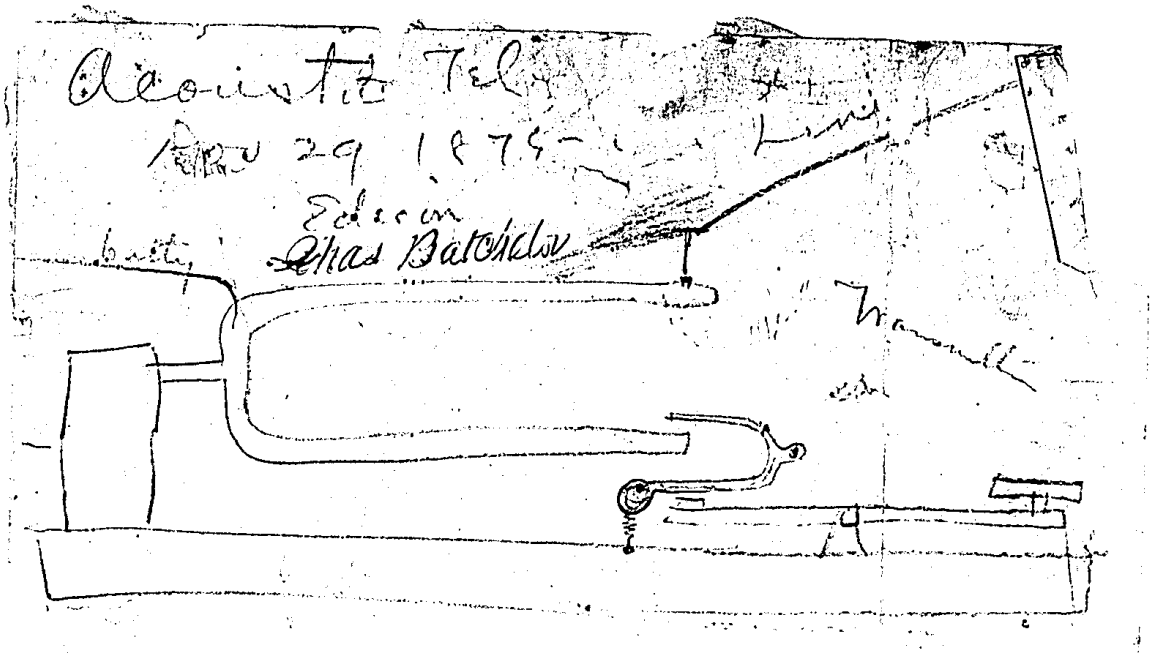
Nov 23rd 1879

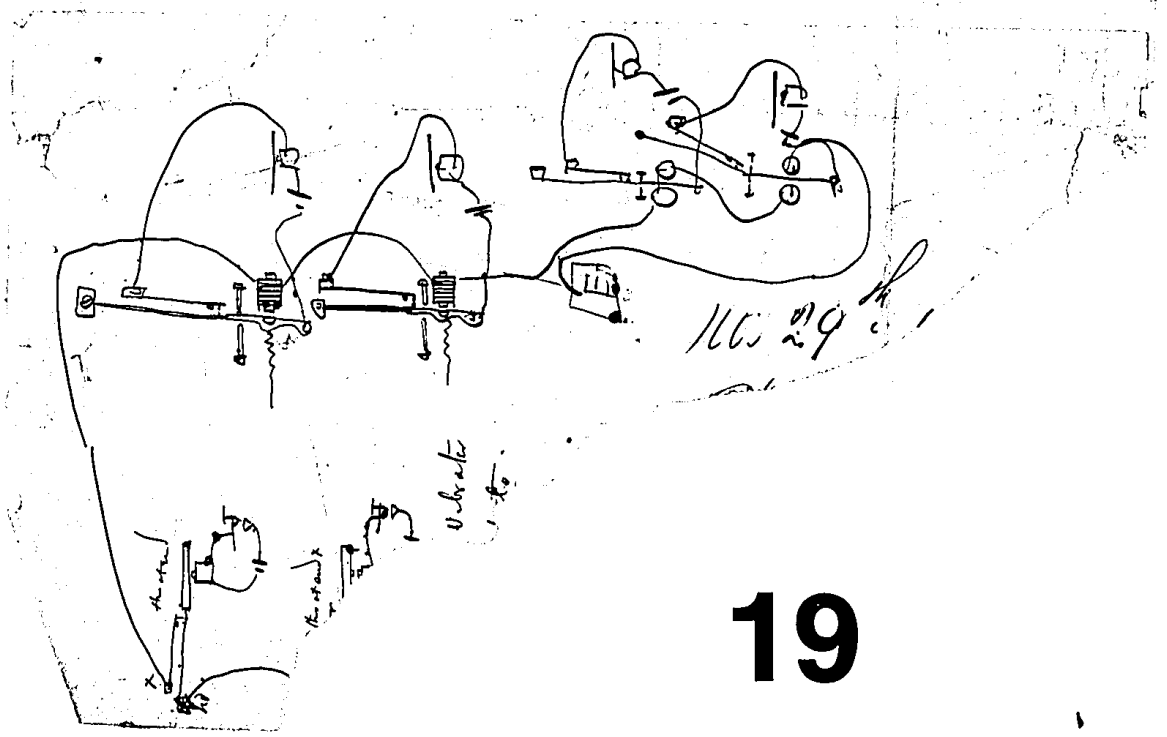
Idea just occurred to me that the paraffine paper used in Condenser should be previously turned into tri-nitro cellulose (10) Explosive paper by nitric & Sulphuric acid which & becomes a bad electrical insulator & probably increases the Electrostatic Capacity of the Condenser Enormously

Chas Batchelor



18





19

(acoustic telegraph)

1	1 1/4	1 3/4	2 1/4
2	2 1/2	2 1/2	4 1/2
4	3	5	9
8	6	10	18
16	12		

10	10
7	7
4	5
1	3

1	1 1/4	1 3/4	2 1/4
2	2 1/2	3 1/2	4 1/2
4	5	7	9
8	10	14	18
16	20	28	36
32	40	56	72
64	80	112	144
128	160	224	288

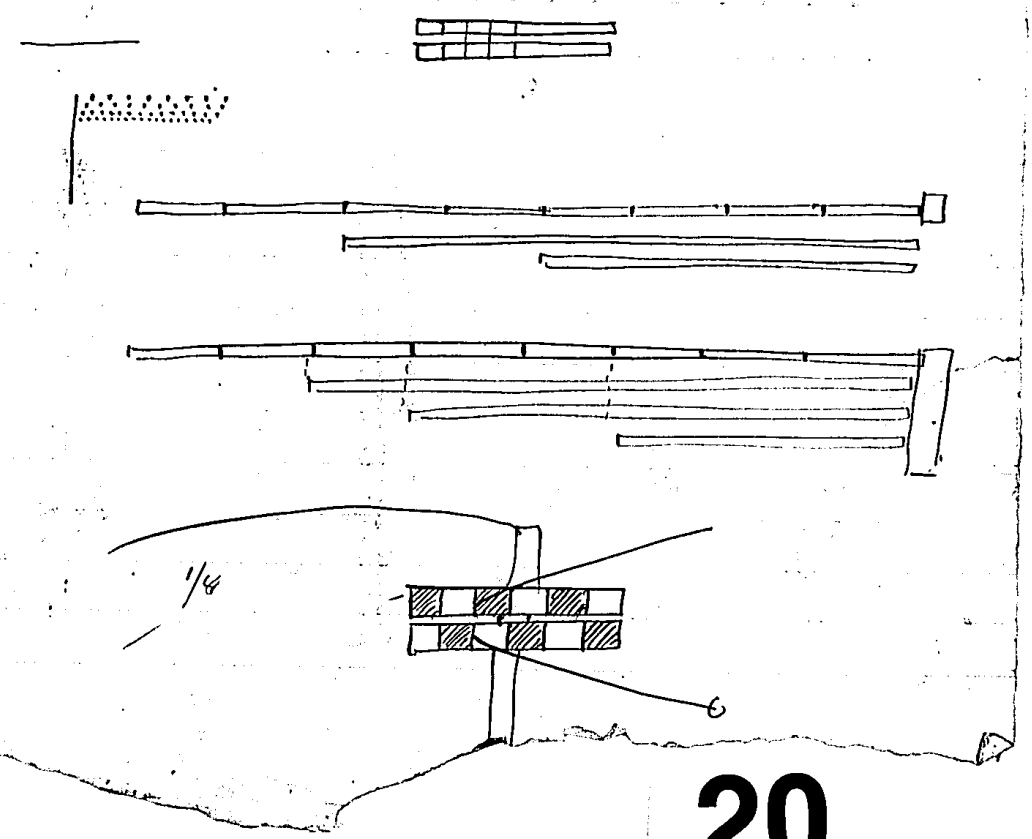
Table of Reed Lengths

Dec 10 1876
T A Edison

8

500.

80.



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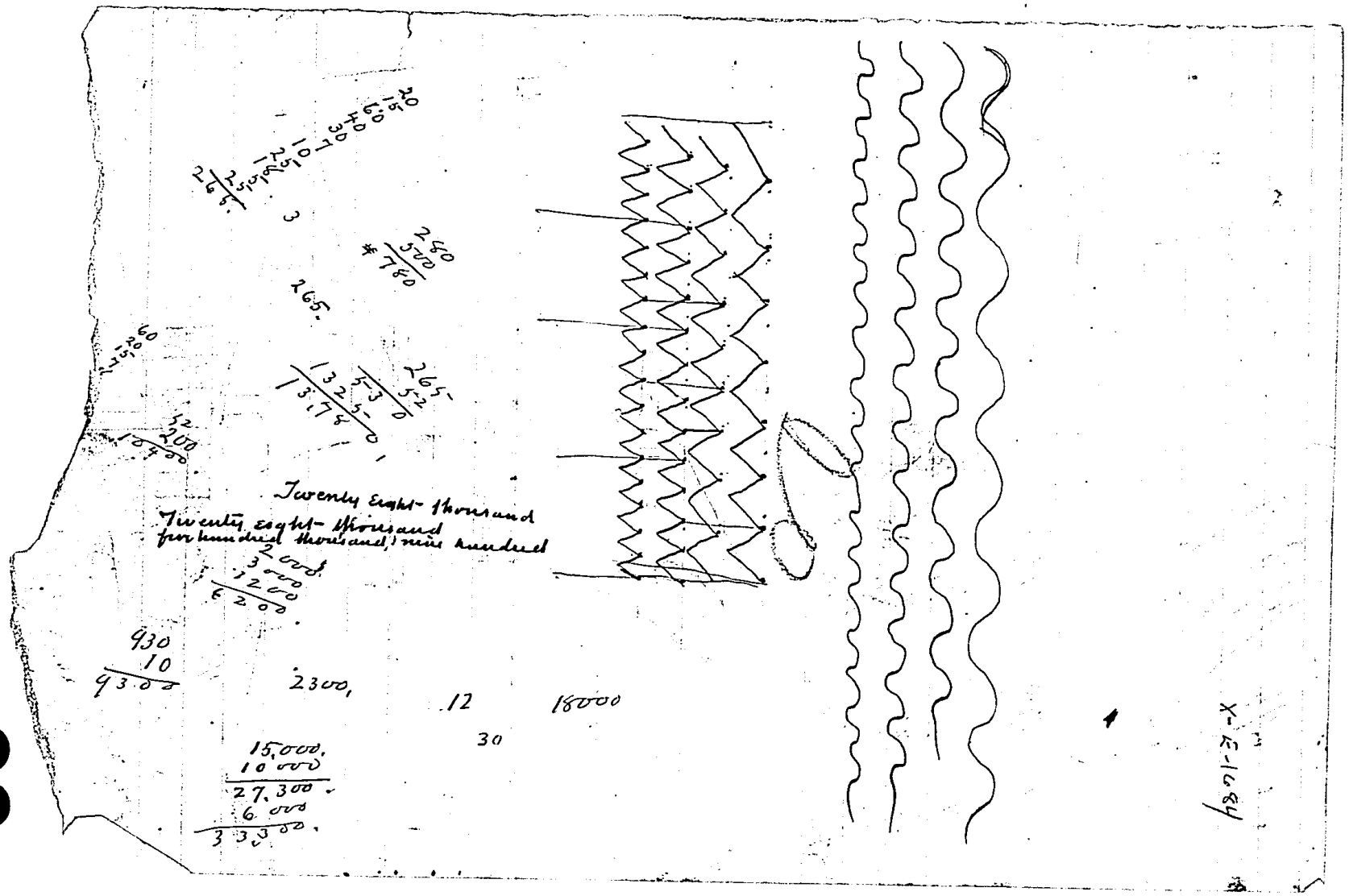
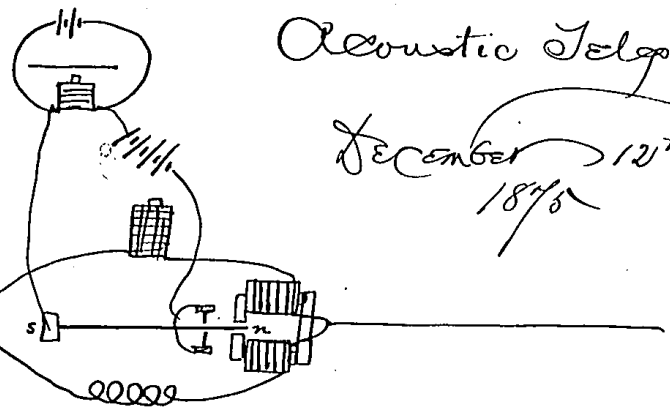

Twenty Eight- thousand
Twenty eight- thousand
five hundred thousand, nine hundred
2300,
12
18000
30
15,000.
10 000
27,300
6 000
33,300.
930
10
9300
265.
260
300
780
265
53
52
1325
1378
60
20
15
12
200
1200
2000
3000
12000
62000
40
30
10
2
1
20
15
X-E-1684

20



Acoustic Telegr

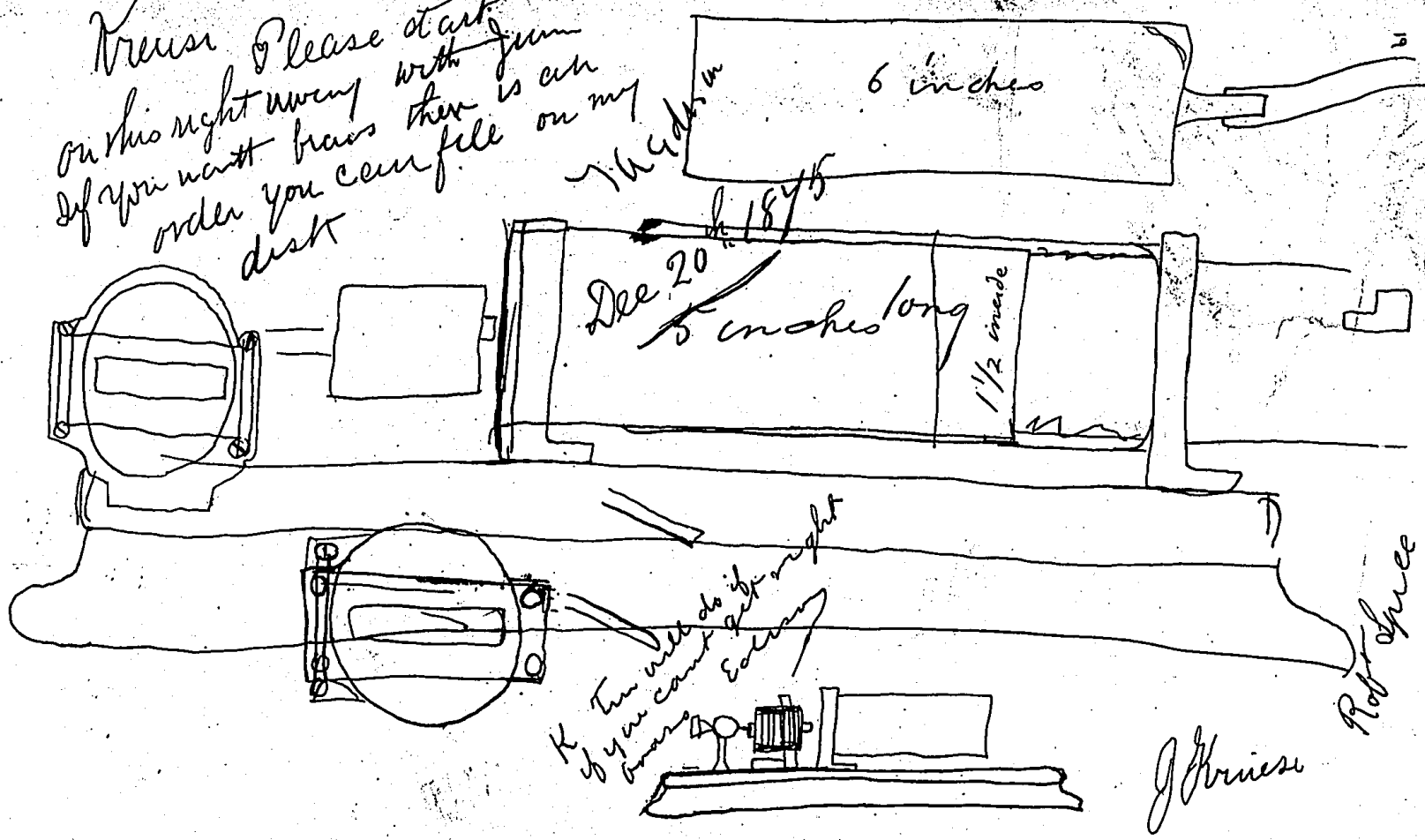
December 12th 1876

Working 1/10 reed by induction

Currents =

Kruesi Please start on this right away with jam If you want brass there is an order you can file on my desk

Wednesday Dec 20th 1875



Robt Spence

J Kruesi

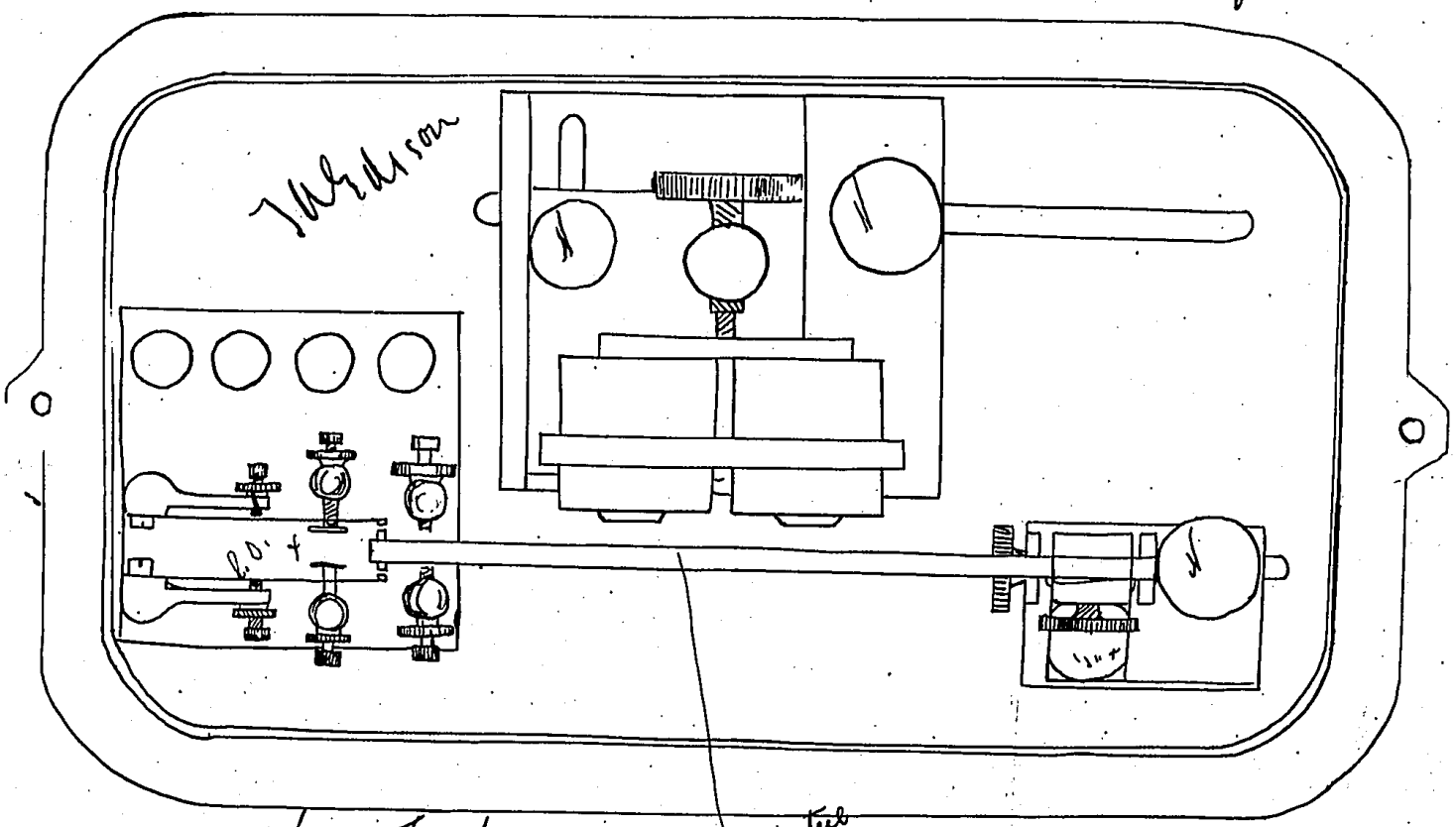
22

Autographic Telegraph

23

Acoustic Telegraphy nov 21st 1875

6 of these



Rotor fuse

2 of these first

3/16 x 1/4 steel

Chas Batchelor

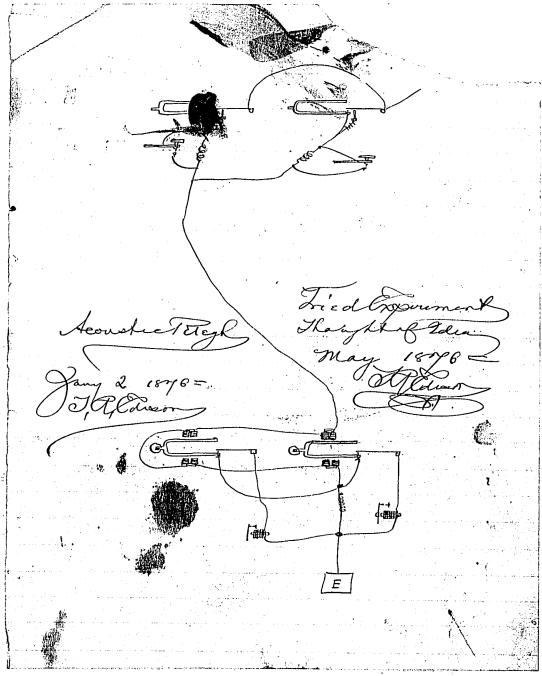
J. Kruse

Notebook, Volume 10

This volume covers the period January-November 1876. Most of the notes and drawings are by Edison; others are by Charles Batchelor, James Adams, and John Kruesi. The material in this volume relates primarily to acoustic telegraphy and to the use of the acoustic principle in multiplex telegraphy. There are also a few drawings of the etheroscope. The volume consists of 116 numbered, unbound leaves. Pages 74-85 were numbered in reverse order but have been filmed in their proper sequence.

Missing pages, found in facsimile in the Telephone Interferences: 3, 25, 58, 71, 73, 101-104, 109.

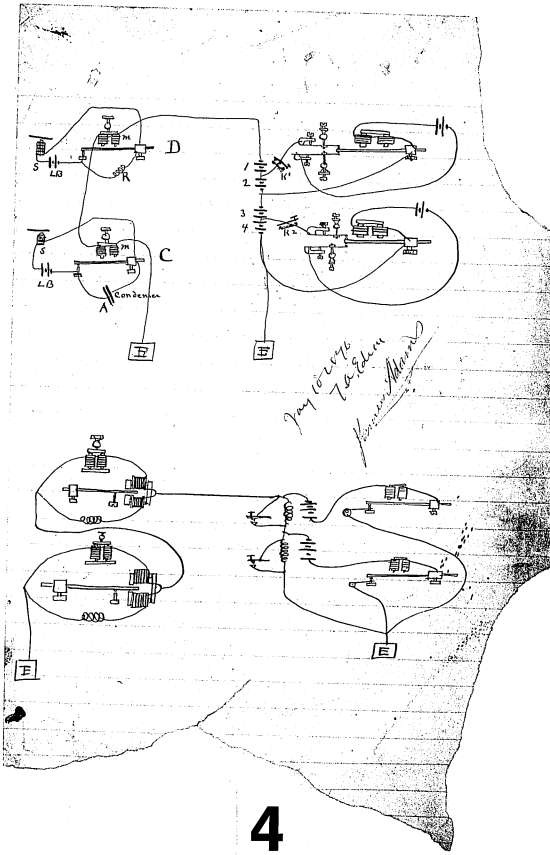
Missing pages: 1, 12, 68, 99.


Acoustic Telegr
Jany 2 1876
T A Edison
Tried Experiment
Height of Elec
May 1876
T A Edison
E

2

0/10 ~~Oct~~ 8 & 9 1870

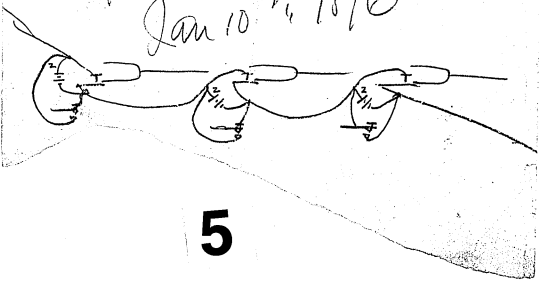
Gen. R. Shoemaker


D
C
S
LB
R
A
Condenser
E
1
2
3
4
K
K'

The Edison Not 9 [illegible]

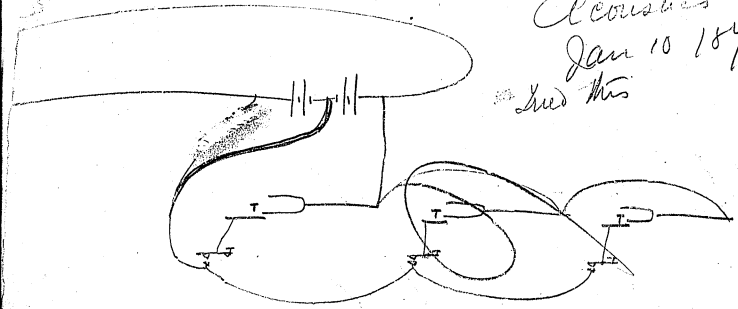
Yours Hers

Jan 10th 1846

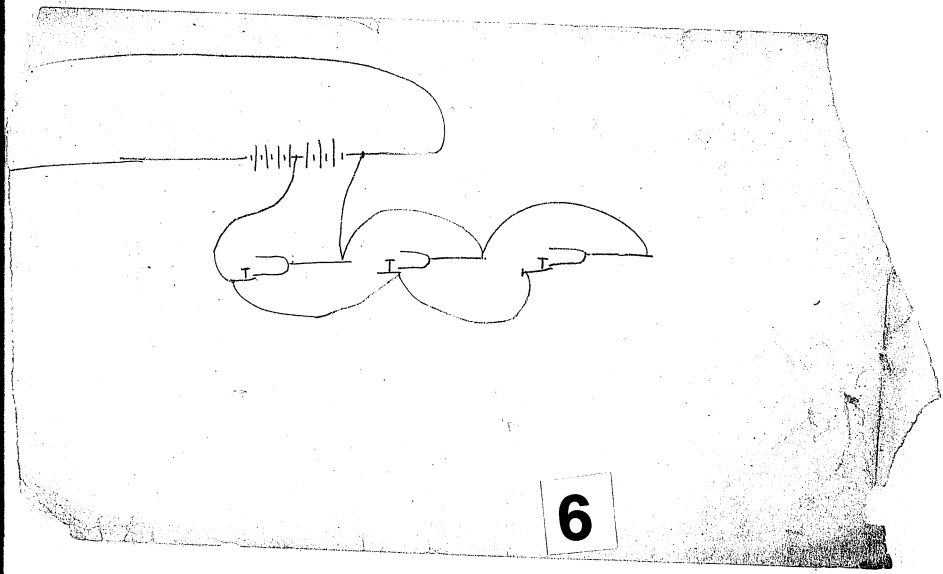


5

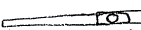
Acoustics
Jan 10 1896
Used this



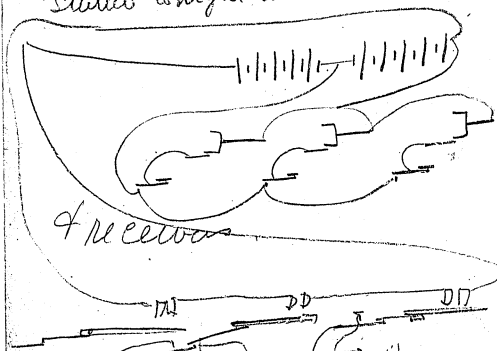
6


T
T
T
6

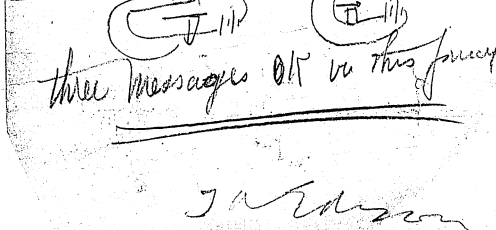
Alters Rec/ reds so that they ought to have been made so as not to produce a node in them in vibrating so



Starter bright with



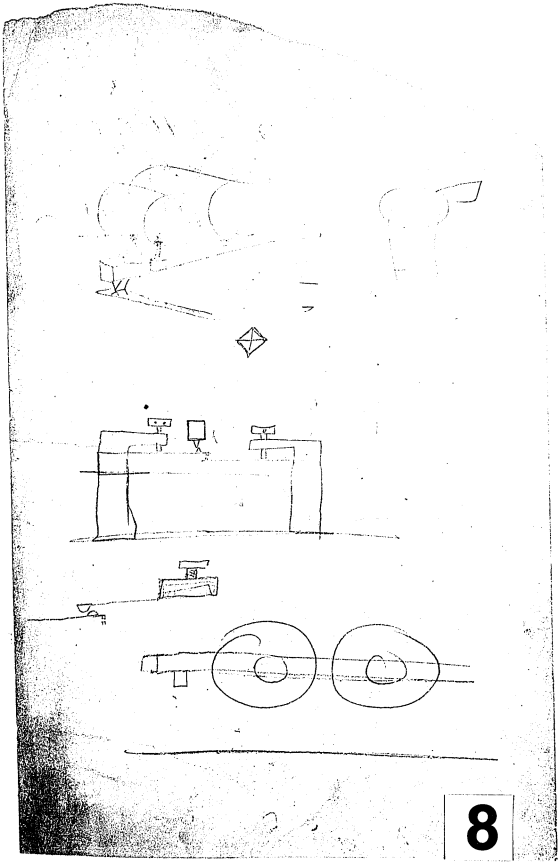
& receiver

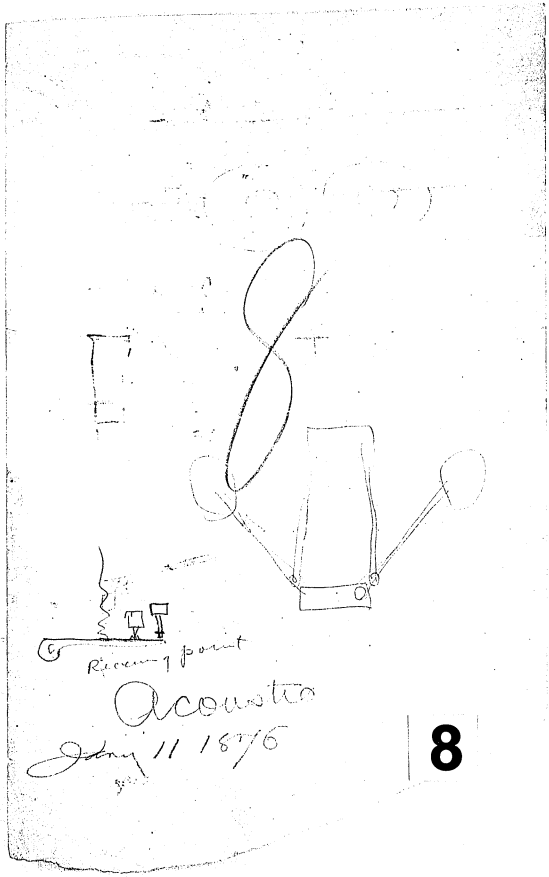


three messages OK on this principle

T A Edison

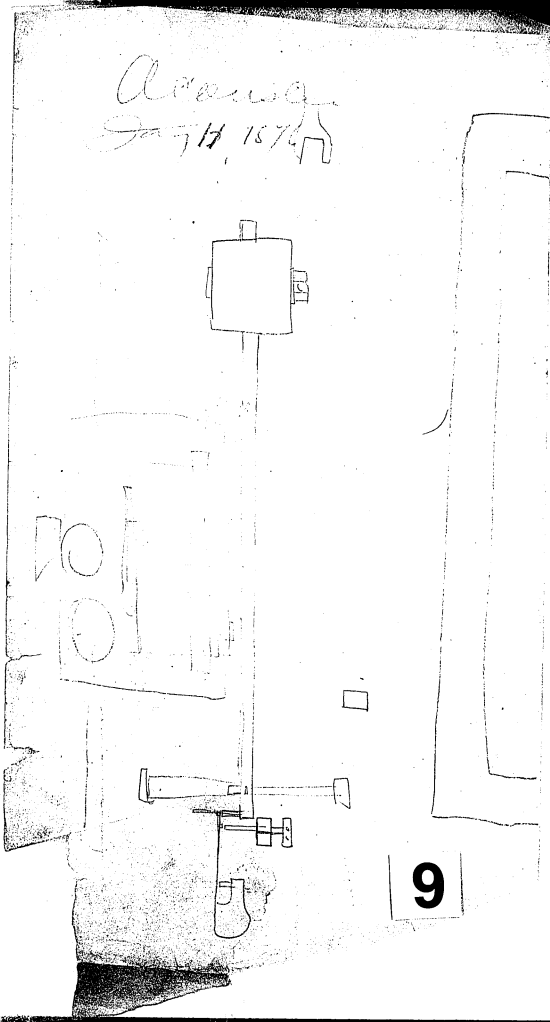
7



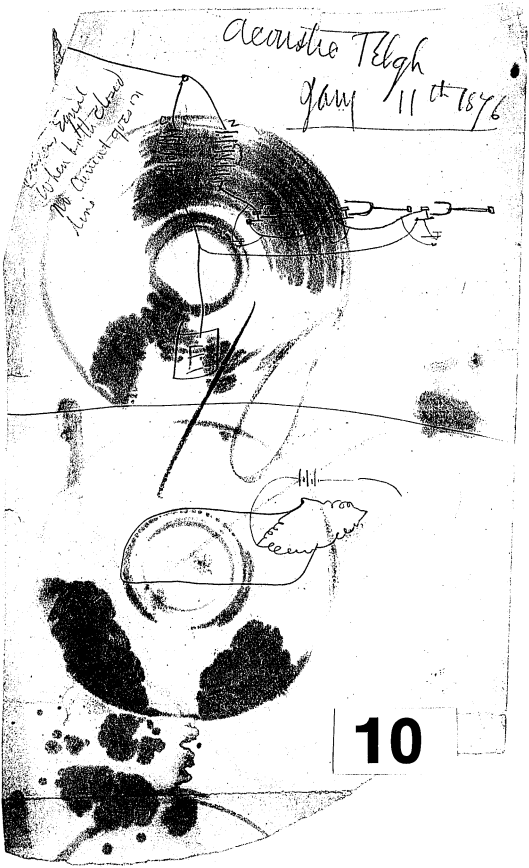


8

Drawing
Jan 7th, 1876

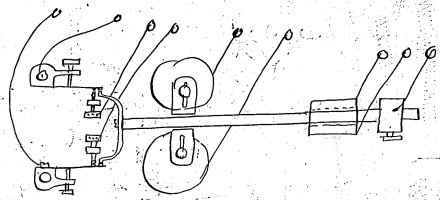


9


Acoustic Tilgh
Gary 11 th 1876
10

Jan. 15th. 1876.

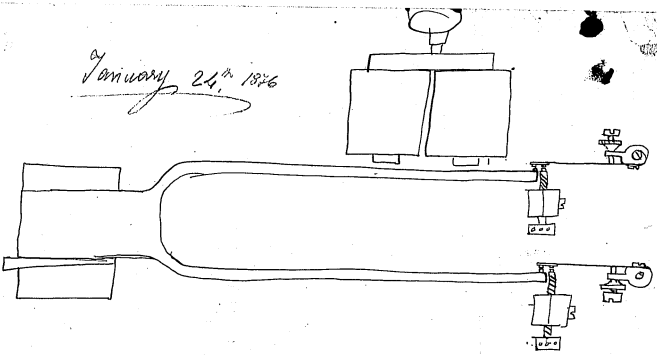
Smith



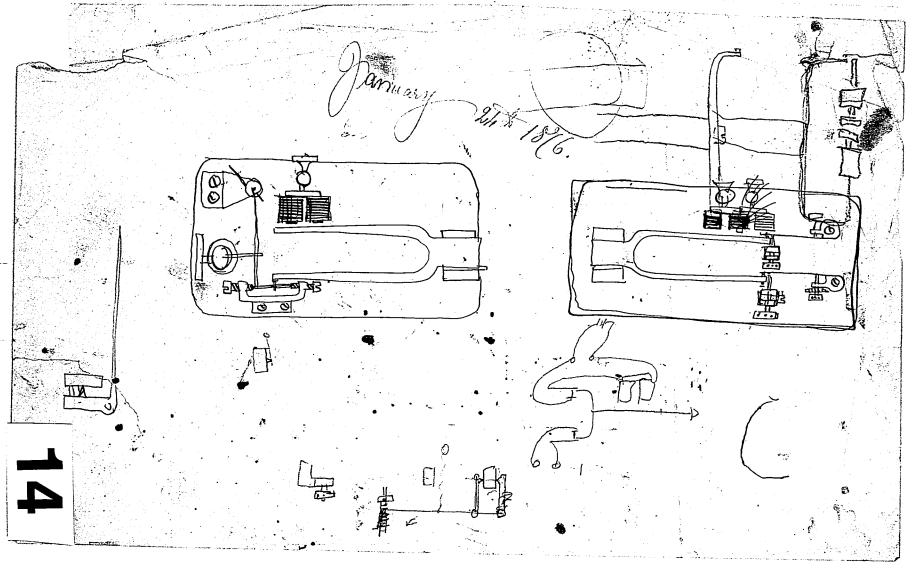
New Style Vibrator

11

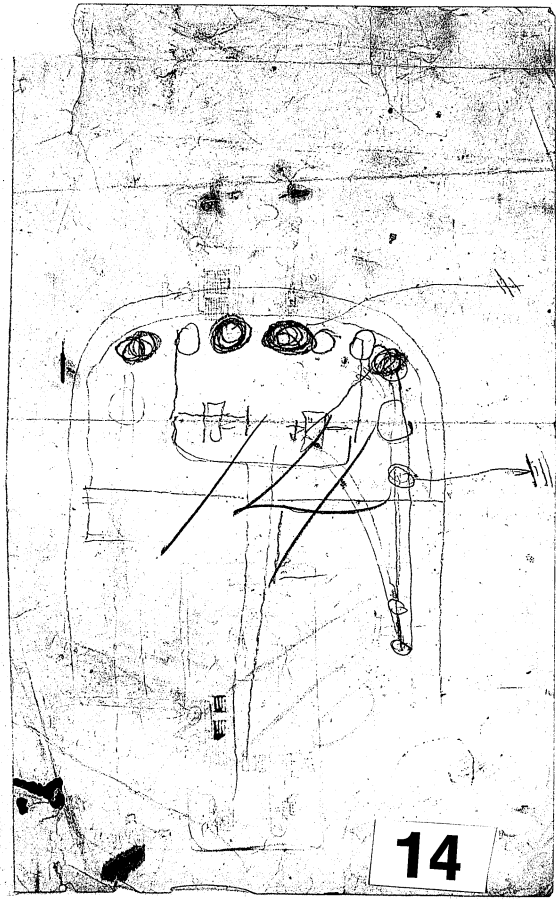
January 21st 1886



January 27th 1876.



14



/// //

Tonight. replace the spring selfoxbtq points
on transmitter with rigid points and make
frontpanel more rigid.

Make both higher notes, and much weaker
together as to now we have

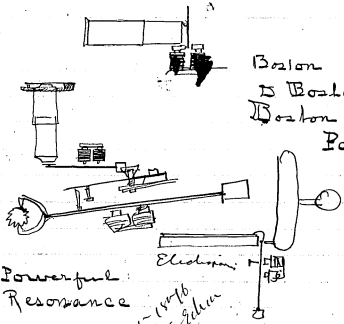
Hugh note
low note.

of course they interfere,
should be this

Boston Boston

Boston Boston Boston | Boston Boston
Boston Boston Boston Boston Boston
Jim Bell Butch dad opici. Elvira.

E Gill Butch. see dad spic + span and on three needs

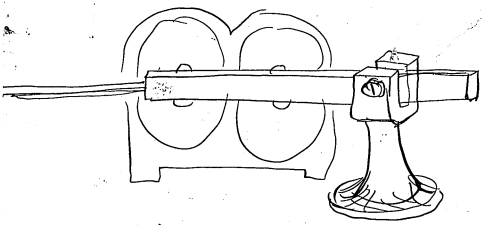


Gray 25-1946
Yale Glen

February 6th 1876 C. Wirth

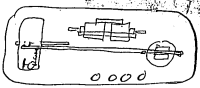
Wirth=

I find that I can make the new acoustic receiver work all right if I do not tighten the screws. It does not want to be so rigid make it thus



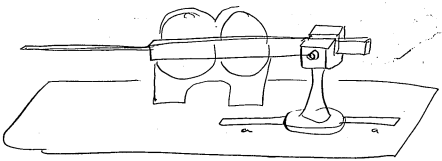
It wants to be a pillar that will give a little. I think the same size pillar as is used on the magnet for holding the adjusting screw= only fix the one down stairs with the pillar=

Kirk



Fix the transmitter so I can put paper in all the same as you have done on the transmitting reed having the highest note. It is a success

Also put the ~~the~~ two other Receiving reeds together. making the pillar adjustable in a long slot



also make the magnets adjustable also the Local points. I have marked in ink on the recess down stairs about the length of the slots for magnet pillar & Local points. =

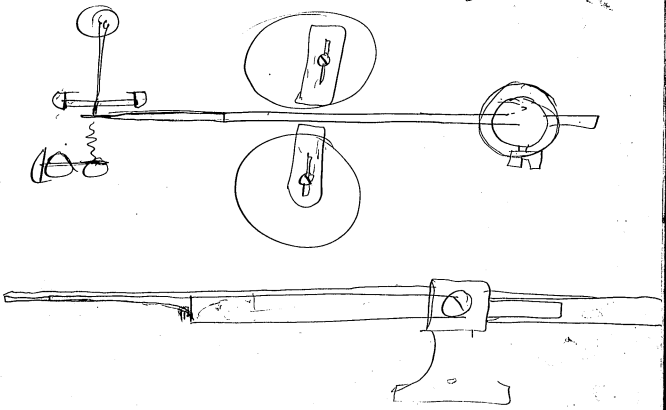
Edison

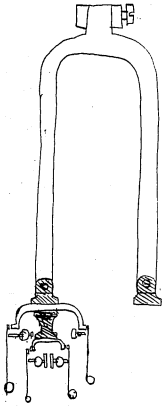
You better put an extension of the hard rubber on so that the adjusting spring pillar will be on it and all to be moved together = put the binding posts up front of the magnets on this side of the [illegible] and ~~solder~~ stiffen up the [illegible] reed by adding another piece

E

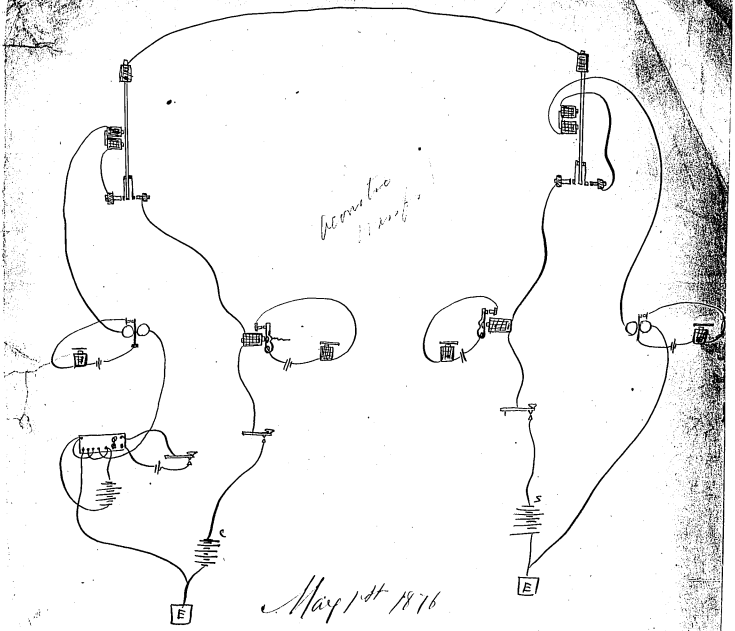
17

February 16 76



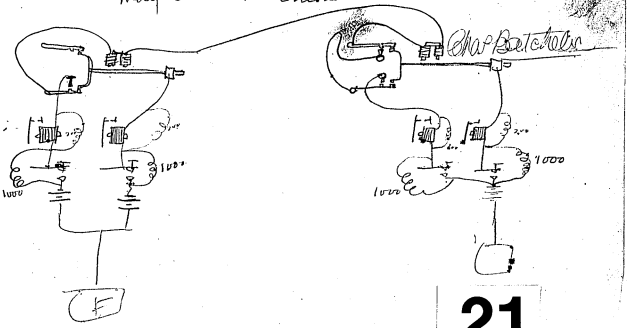


19

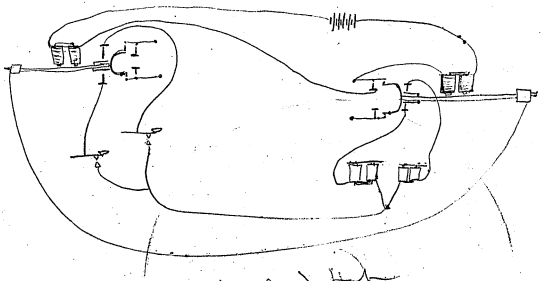


20

Keeping 1 line on two sets of same human co,
May 8 1876. Edison



21

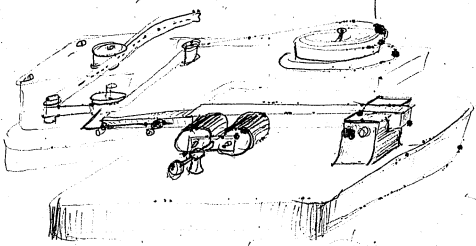


Works real well

May 8th 1876

22

May 8 1876



Edison

Acoustic Telegraph

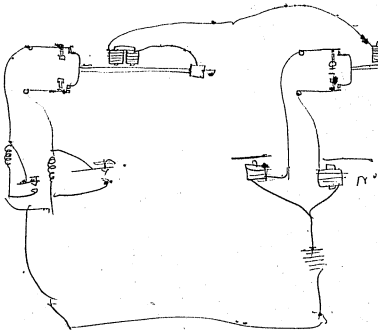
Recorder

23

② Wires out — May 8 1876.

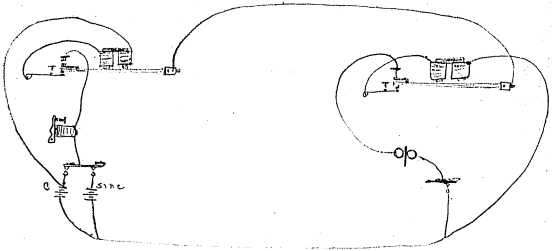
X

Chronometer



main line direct to Reed =
X " 2 Ohm spool
The variation in resistance makes it hard to get at hence failure

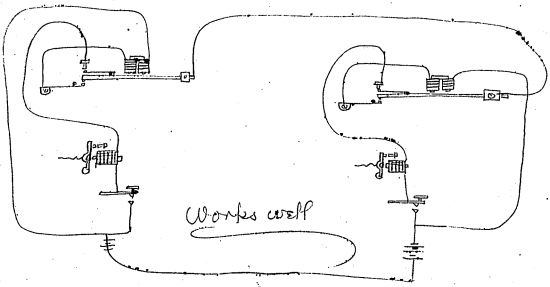
24



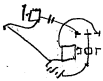
Works Splendid

May 10th 1876

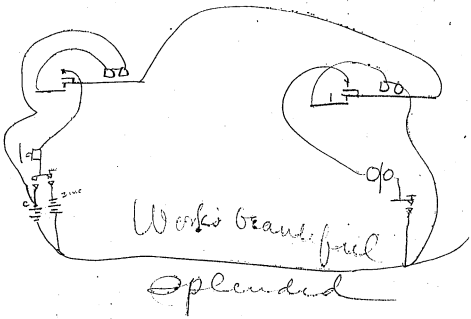
26



May 10 1876



27



May 10 1876

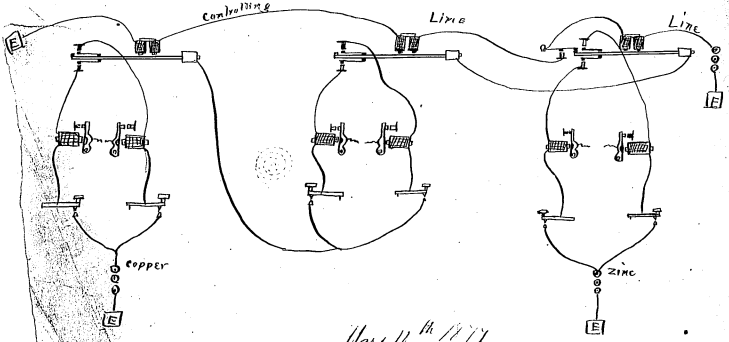
Thomas A. Edison

(Better than Crowell)

Even with a single ~~cell~~ pole & relay with slight magnetism or extreme low off & wk ~~hand~~

28

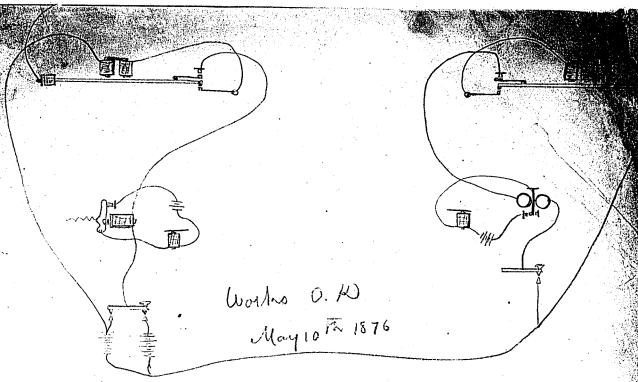
May 10th 1876



May 11th 1876

James Adams

29



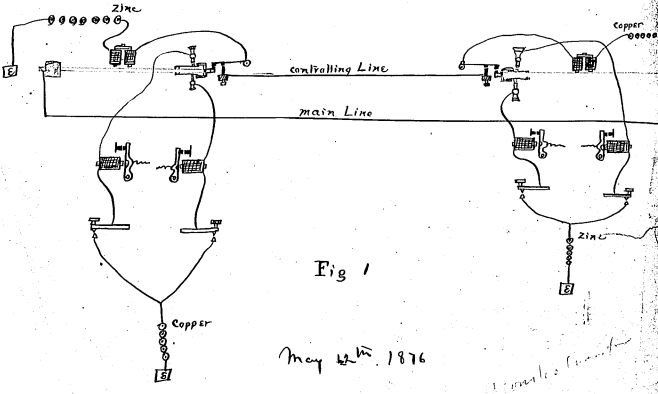
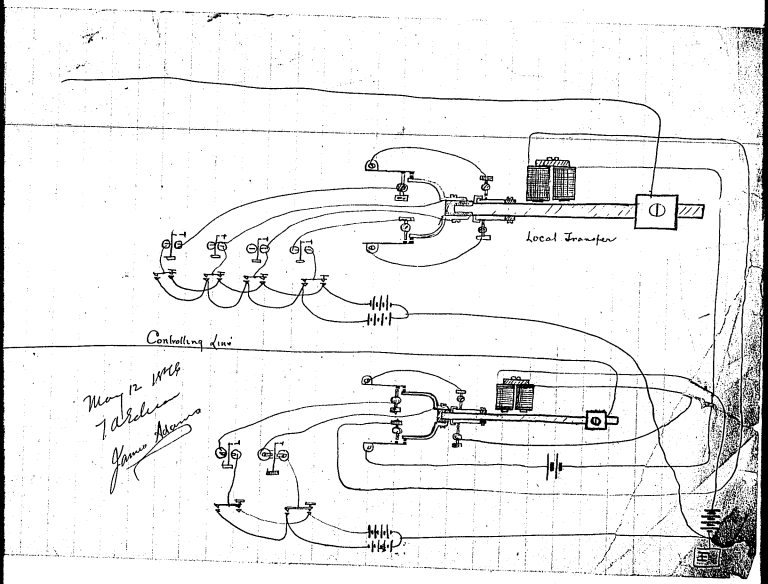
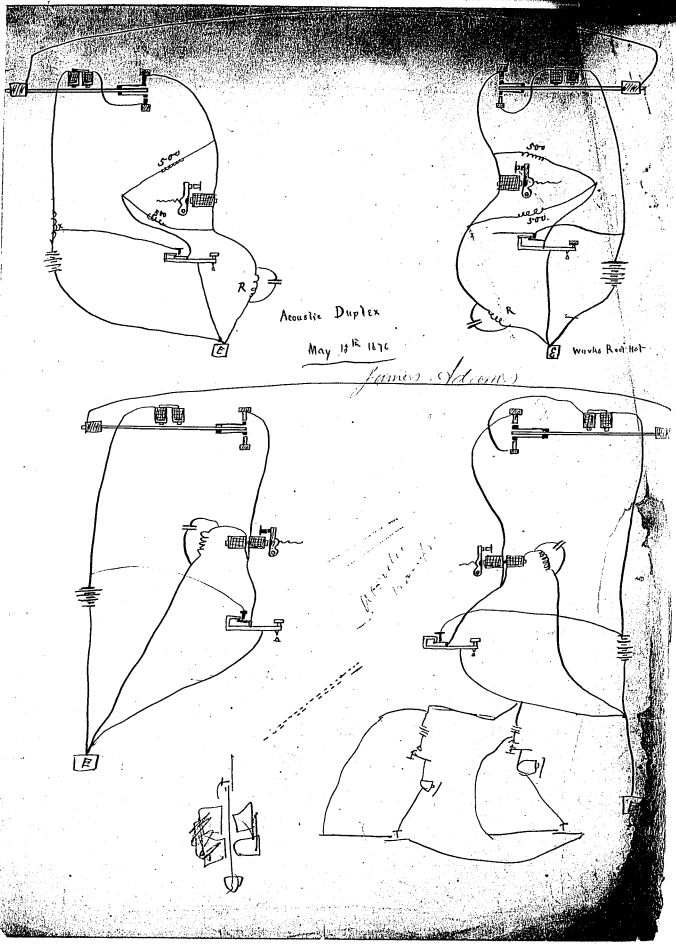


Fig 1

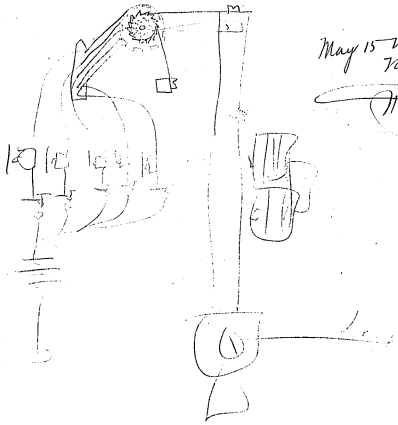
May 4th. 1876


Local Transfer
Controlling Line
May 12 1908
T. A. Edison
James Adams

31


Acoustic Duplex
May 13th 1876
James Adams
Works Red Hot

(accoustic telep.?)



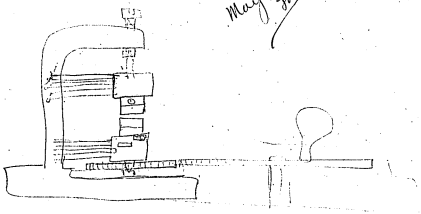
May 15 1876
Tatum

Wadsworth
33. 50

33

(acoustic telg.?)

Magjetto
JAS



Boston Boston
This agreement entered

B
Boston Pier

34

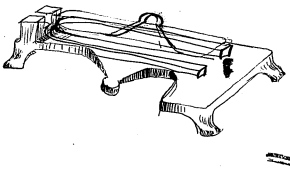
35

(acoustic telg.)

36

(acoustic telegraph)

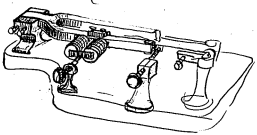
July 2 1876
TAEdison

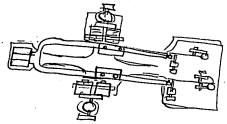


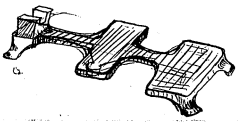
37

(acoustic telg.)

July 2 1876
TAE



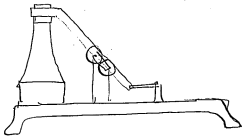


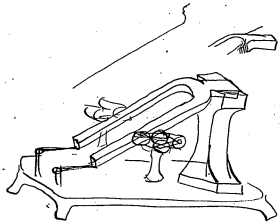


38

(acoustic telg.)

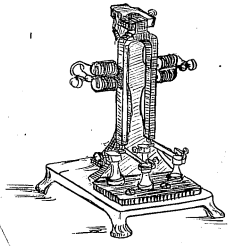
July 2 1876
T A Edison





39

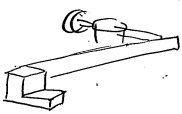
July 2 1876 T A Edison

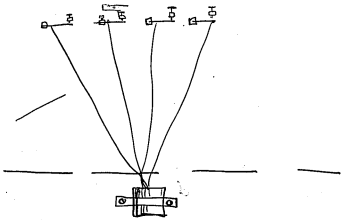


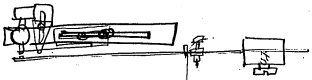
40

July 3 1896 TAE Adams

James Adams

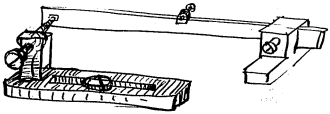






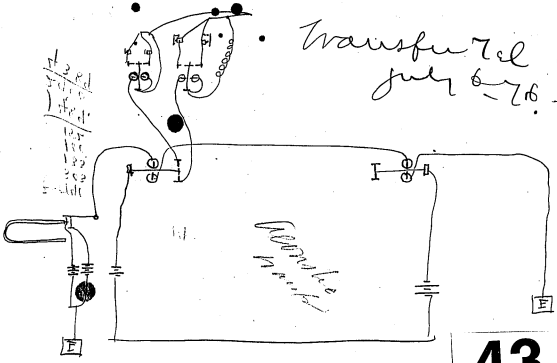
41

July 5 1896 TAE



James Adams

42

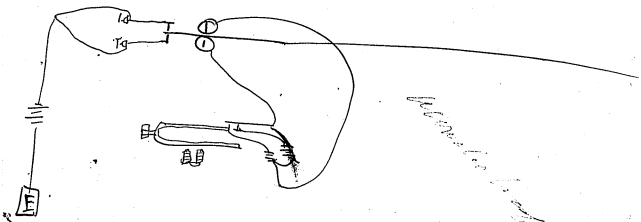


Transferred July 6 76

43

Transfer July 7 1876

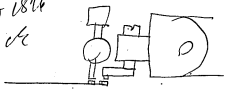
James H Bowles

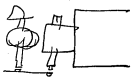


Boston Boston Boston Boston
Boston

44

July 10 1896
TCK





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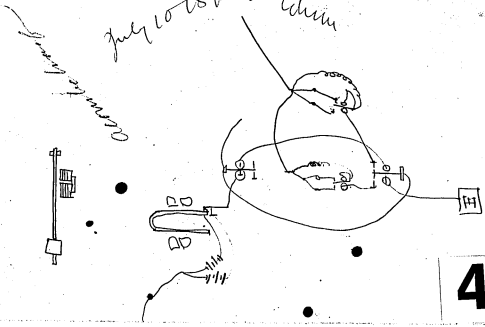
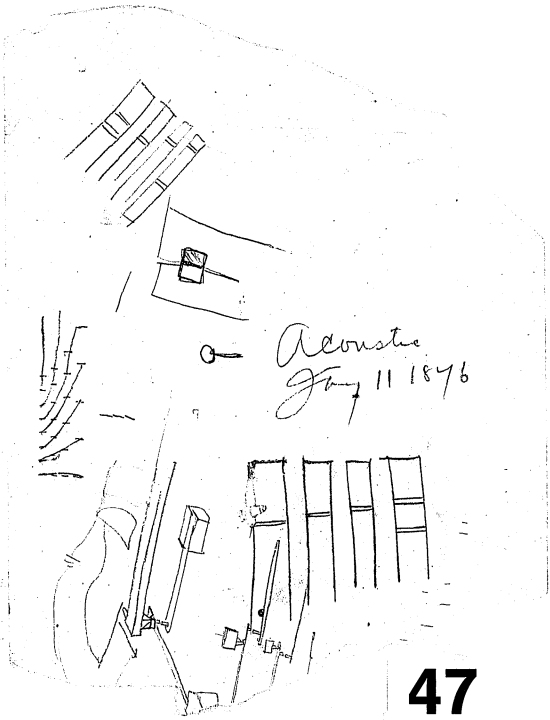
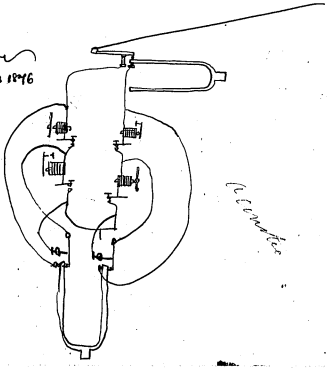


46

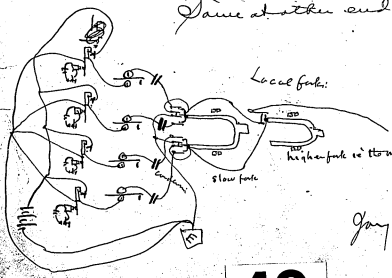

Acoustic
Jany 11 1876

Acoustic Transfer
Telegraph July 13 1876
T. A. Edison
James Adams



It is possible that when we get the transfer relay will serve as splits working that we can use one of the splits to work the local line dispensing with the Controller of line.
Tried this last night and it worked well over line between Menlo Pk and Albany & return with only 40 cells small carbon to transmit on

Same at other end –



Jany 26 1876.
J A Edison

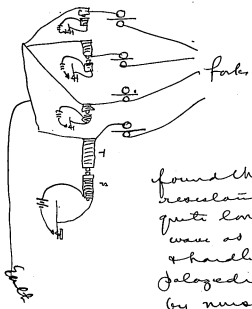
James Adams

on closing the key the ground is disconnected and the battery connected to the rushes over line to the distant station (which in practice will frequently have its condenser cut out (1e) in the particular split reading) and the wave continues only until the condenser is charged which takes place with tremendous rapidity. this short wave which is perhaps only the length of a single vibration of the local battery passes over the wire & scarcely charges it but is sufficient to throw the torque of the polarized relay to one side. when the battery is disconnected & the split put to earth the condenser which is now fully charged — discharges through the line in an opposite direction to the wave which passed into it from the line & this serves to throw the torque of the polarized relay over to the other side. the great advantage of using these short waves & polarized relays

Consists in using very weak current which and polarized relays, readily respond to and also a very short wave of current of the 2 polarities which are all that is ~~only~~ required to make dots & dashes; hence the wire is not charged anywhere equal to what it is when permanent batteries are used at both ends and the effect of the escape is entirely prevented with the case by receiving on a ground, when the wire is thrown on one set of instruments the wave is transmitted and then the wire before it is thrown on another set is put to earth simultaneously at both ends, so as to dash as far as possible ~~through~~ the static charge of the line caused by the passage of the signalling waves & the prevent it from rushing to earth through the next set of instruments on which the line is thrown instead of the condenser we tried using the induced current from an electromagnet

Thus

July 26 1886
Fahlstrom

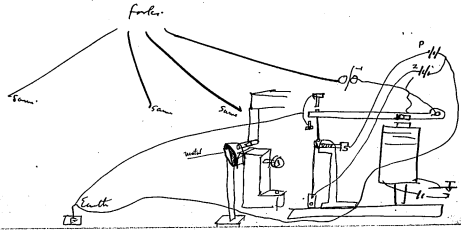


found that S must be of considerable resistance & that T should be quite long so as to lengthen the wave as it is exceedingly short & hardly sufficient to throw the galvanometer over to the left, by running etc perhaps this would work satisfactorily it has one advantage that if any station one used

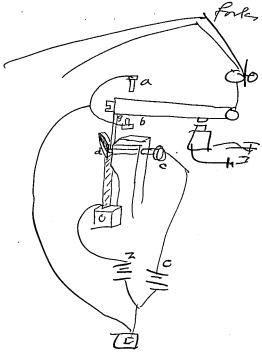
local batteries will be all that is required to work the inductor magnet thus dispensing with main battery = we also tried in place of S & T a differential magnet one set of wires = like the other in local battery. this was not so powerful but could be made so

July 26 1896
T. A. Edison

In place of previous induction currents of short duration, mention battery currents could be used and special mechanical device used. so that upon closing the key, it or a sounder operated by local battery could be made to connect the battery p to line for an instant & then ground. then upon opening the key the ground could be removed and z pole of the battery connected to the line for an instant followed by dead earth. the idea is illustrated as below; of course there are many ways of doing this which any skilled person in the business could accomplish =



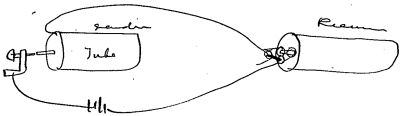
53



when key open lever of armature rests on a piece of ebonite to prevent
in passing from wire rubs on piece of C mounted in
wooden or other insulating substance = that sends
Copper Current of short duration over wire
when lever of armature touches b & grounds
spot of quicksilver lies over platina cylinder
on end of piece g passes on the metal d
& connects z pole of battery to line for
instant when it rises over top of d
when lever touches a & grounds again

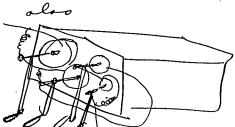
It may be necessary to shunt the polarized relays with either a Condenser or a Secondary Battery so as to hold the lever or tongue to either side while no current is being received over wire thus preventing Extraneous currents from affecting the relays. or perhaps by the use of reverse battery a strong wave could be sent to throw the lever over many followed by a weak current wave to hold it so or always keeping weak current on line to hold lever on one or the other side.

Last week we tried numerous experiment with a speaking Acoustic Telegraph which by the human voice could be transmitted over a wire & which I have neglected to record.



brass diaphram also used parchment.
sending Hadaprojection from middle of
diaphram to a contact screw by speaking
in tube diaphram set in motion & breaks
transmitted to receiver ~~set~~ the magnet acting
on armature screwed to diaphram set it
in motion. Speaking was inferior but the
singing was very clear & musical,
tried tubes of various diameters & length.
diaphrams of various thicknesses

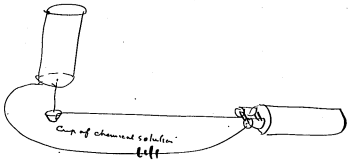
also



same Receiver

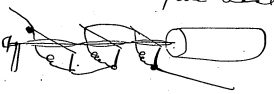
in end of box placed several diaphrams
of different diameters each of which had
a contact point the point owing to

Cut in out of the circuit resistance but were breaking the continuity of the circuit, this owing to bad construction of apparatus appeared to be a failure yet I think if properly made it would be a success. also tried a single diaphram.



with platinum point dipping in a shallow cup of chromic solution the vibration of the diaphram serving to transmit waves to the screen by mirror and diminishing the resistance of the circuit. This appeared to give best results.

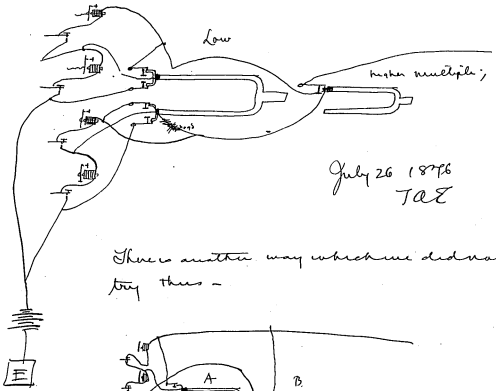
Tried



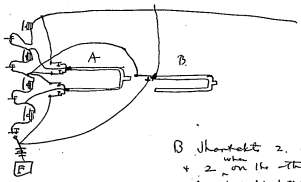
vibrating thread

There is a different plan for transfer which we tried and which appears to work very well which is the cutting in and out of the main circuit two receiving instruments simultaneously at both ends of the circuit at the same time and then doing the same one after the other of several instruments. We found that it worked perhaps more satisfactory with Common instruments that by the transfer of the wire from one set of instruments to the other. probably on account of the short circuit which closes on each instrument immediately after being thrown into the line acting as a shunt to allow of the circulation of the self induced current of the magnet itself which has a tendency to make the magnetism of the lines more continuous. The drawing is shown on the next page, there is a difficulty with this in which is the difficulty of discharging the wire after

or between Coil transfer. we tried innumerable devices such as Condensers magnets secondary batteries arranged in various ways with the instruments & central devices to compensate for the static charge of the line but with small success. Drawing shows one end. (Encl'd about month ago)



There is another way which we did not try thus –

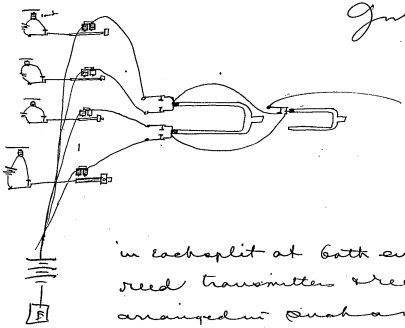


B Short ckt 2. when on one side & 2 when on the other side.
A. Short ckt 1 on one side 1 on other side.

60

Perhaps the following would work, upon a line with great electric capacity as the reeds would only respond to their particular rate & independent of all extraneous current out of time with it no matter if everything

July 27
1876
T A Edison

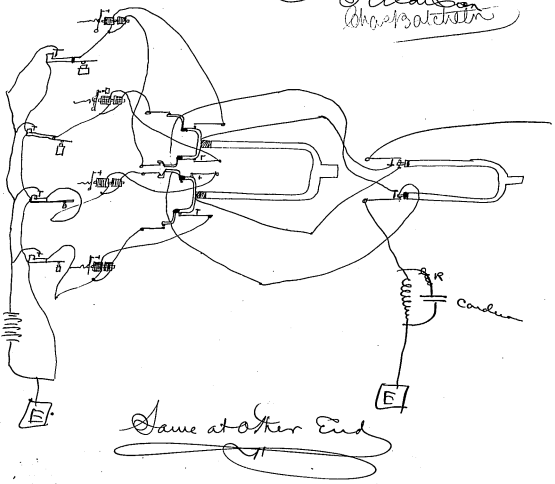


in each split at both ends are reed transmitters & receivers arranged in such a manner that you can send or receive the rate of vibration being very much greater on lowest Reed than the trumpet or Deutsch forks —

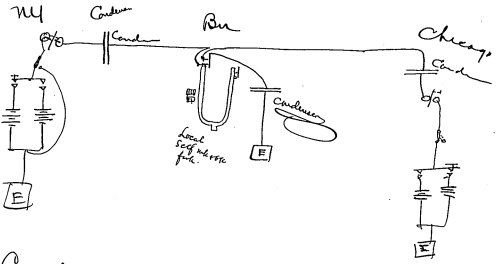
61

It seems probably that a system of Compensation could be obtained by using artificial line & extra splits using also differential relays thus.

July 27 1896



A Repeater



Can be several hundred forks put in along wire. This circumvents the law of the Squares.

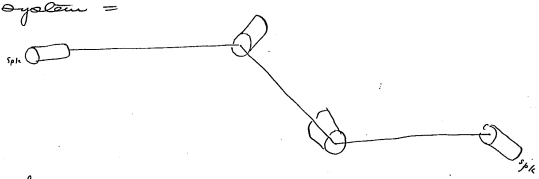
Conceived about 3 weeks ago.

July 27 1876

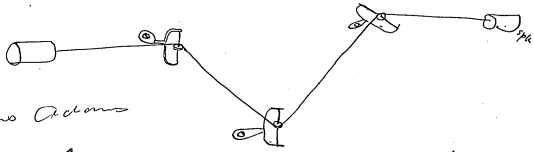
J. A. Edison

James Adams

Acoustic annunciator for stable
private house etc.
Use tin tube covered with a
diaphram or. Use silk thread a
Conductor of the vibrations
turn corners by use of wheel
and also diaphrams. I have tried
large number of experiments with the
system =



also.



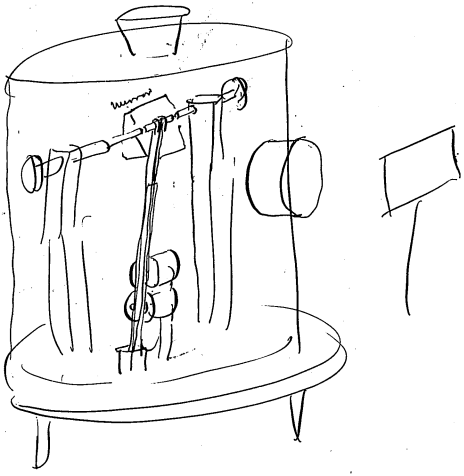
James Adams

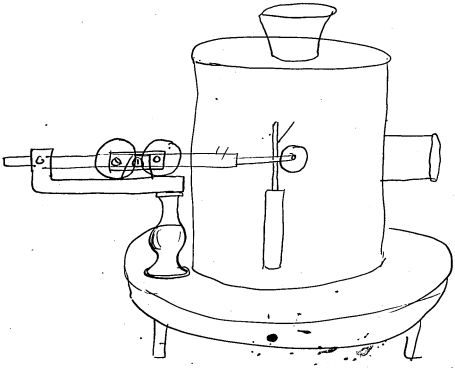
July 27. 1876
T.A.E.

Tried this 2 weeks ago
works fairly

64

I propose to make a Ethereoscope
thus

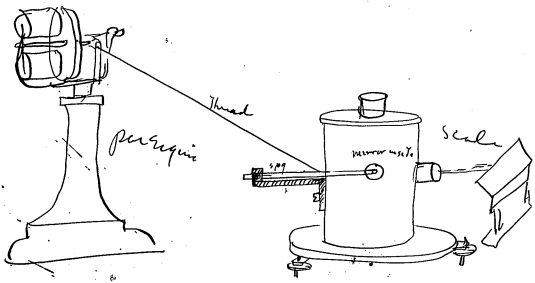




Thenoscope

Jul 27, 1858

Jas Adams

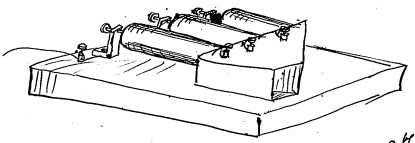


Electroscope

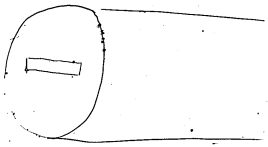
July 27. 1876 J. H. Wilson

James Adams

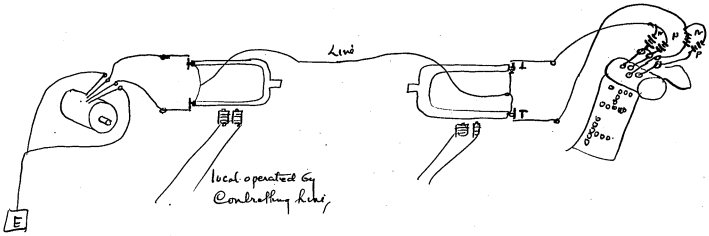
speaking Telegraph



July 24 1876
T A Edison

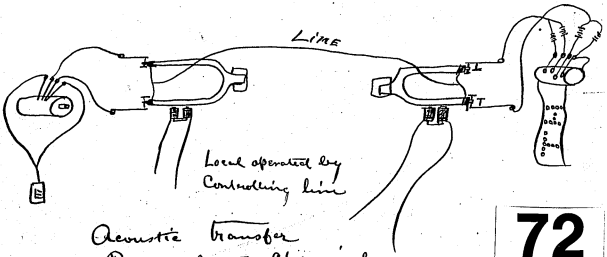


69



Acoustic transfer
Roman Letter Chemical
printing telegraph
July 27 1876
T A Edison
James Adams

70



Acoustic transfer
Roman letter Chemical
Printing telegraph
July 27th 1876 Adams

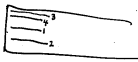
72

73
10

Part 8 – 9

Gen. Pol. Intelligence

(July 28, 1876)



Position of lines

Acoustic Transfer.

Experiments with a Chemical recording instrument at the receiving end with the 4 split connected to ~~the~~ four non recording points drum to ground at other end 60 cell small battery. Relays in split. Phila wire, weather moist Kennedy report wires delicate doggy = Samples marked A. result of why I key at times making long dashes, = ~~noticed that [illegible]~~.

Exhibits A & B are the record with the ground wire, executed in the low fifths the supposition being that immediately after the line has been taken from I set instrument

85

& before it is put on another the idea being that putting wire to dead Earth would free it after the change

Exhibit C. is the wire on short clot the ground wire having been [redacted] on the Multiple forks at bottom ends thus

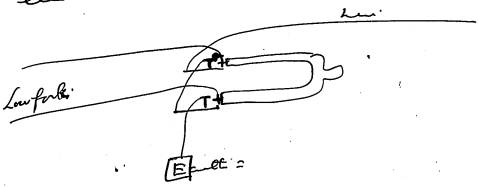


Exhibit D shows same with Phila on — These show where the mysterious bug was the equipment for "earthing" the wire on the low forks was a failure while that on the Multiple is a success =

now then Explain

why all my runkles failed
Exhibit E will show ~~that~~
the effect of the return charge
~~to~~ ascertain if the ground wire
is sufficient to discharge the
prevent it entering into the
equalizing split = The end
pending Exhibit A, B, C & D
is now to earth with key closed.
Nos 4 1 & 2 split are to pass at
neg ~~shaft~~ end while 3 is
connected to key & bally 36
cells Calland, our next Exhibit
will show the return chg. from
60 small Carbon =
Result. No return charge
from 3 wi. attm 36 cells Calland
Now for 60 Carbon small + 36 Calland
Combined = This will be Exhibit F

F. as Carbon was to line return
Charge was June to pass hence
Exhibits F are delusions as marks
Come under matt paper
We reversed battery to make
A correct and get Exhibit
G when the loop to Phila
got foul of another wire with
battery on & stopped us
going to get RR Station on our
short to get Nel. so we can
have it fixed = 12 Midnight

T. A. Edison

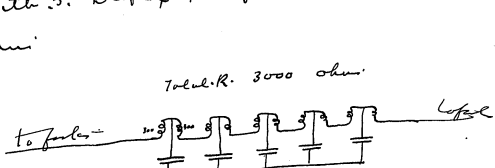
July 28 1896

Phila wire having busted
we now make an artificial line

82

Composed of 5 resistances Bogis
Phelps Duplex patent.
with 5 Duplex Phelps Condensers
Thus:

Total R. 3000 ohms.



4 sheets in each condenser.

We now resume the test of the return charge from 60 cells small carbon + 36 Callaud together. —

Exhibit G.

Exhibit H shows same Condensers power but with 7000 ohms R.R.

Exhibit I shows 12 sheets in each
Condenser - ~~[illegible]~~ think can just
detect a little return charge

Exhibit J shows with same receiver
but with 28 sheets on each condenser
= detection of return charge myth.

Exhibit K shows same receiver
but 72 sheets condenser in each.
It ~~seems~~ Evident ~~something~~
is wrong - We reverse battery
~~Exhibit~~ No - the ground wire being
taken off we get Exhibit L.
which shows return charge is
we have copper to line - L shows
on 2 best 4 next best then .1.

80

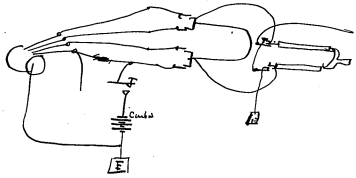
We have in Exhibit M. the
return charge with fork
ground wire disconnected at
both ends = 72 sheets ~~Cond~~ in
each condenser & 7000 ohms
resistance.

Exhibit N same with ground on fork
at distant end =

O. shows with both grounds on

We now reverse Galtery, 2 me to line
R ~~shows~~ get nothing —
I do not understand why we
send out a Carbon Current & get
back a Carbon current.

Pens are arranged letters



Perhaps the forks are little out union and it is leakage back through contact points.

Return Clay —

Exhibit P. shows ground wire off at recg station on at dist distant station with splits to Earth. also with both fork grounds off also with all splits & fork ground off at distant = 9000 ohms in 5 resistance Coils = 74 sheet Condens on each of 5 condensers also shows with distant entirely open with ground here =

78

Exhibit Q. shows instants and
open split grand & all=
at the end. on main Carbon to line.
on our ground. we have a reverse
battery. Zinc to line with 15.
cells. — kills return Completely.

R1 shows 5 cells on neutralizing battery.
R2 " 10 " "
R3 " 15 "

added 84 sheets to the 5 Condensers.
S1 shows 5 cells on neutralizing battery

Now 15000 ohms. 91 sheets C
on each of 5 Condensers.
T1 5 cells on neutralizing battery
T2 10 "
T.3. 15 — wiped out —

New experiments.

7000 ohms. 91 sheets each of the 8 Condrs

Key closed putting. 60 Cab & 36 Cal to line

15 Cells opposite in fork ground

Exhibit ~~B~~. W'. other end all open. Key closed. no exhibit

nothing = Working Key. no exhibit Nothing

Other End Closed, one battery to line

nothing — making dashes. nothing =

= Found that by putting

Back instruments for signalling

that with 91 sheets Condensers

the rush in charge when

acting like an Escape and

although we could only just

get dashes. the Correctness of

the information drawn from the

above experiments cannot be doubted

that is that the insertion of a

wire in the Multiple forks at both
ends to discharge the wire after
Each wave is a very successive
& gives me the required compensation
which can be made as powerful
as desired by the insertion of
neutralizing & opposite pole
battery in these ground wires,
If we receive on a ground
undoubtedly the signals
will be perfect on very long
lines, & I am certain they
will be if way stations are used
whose multiple forks have also
a ground = = with battery at
both ends we find that we have
near the margin, but I think there
will be no difficulty in working from NY
to Washington direct with the 2
ground in the Multiple fork

we close our labors
night at 5.30 am

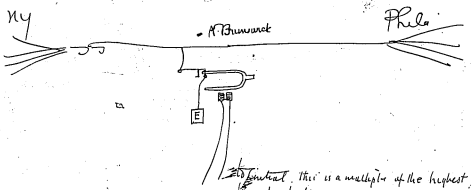
T. A. Edison

July 28 1876

A & Gil on

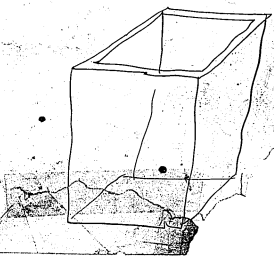
Acoustic Transfer

July 28 1876

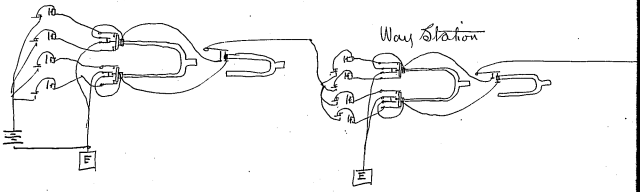


Instead this is a multiple of the highest tuning fork

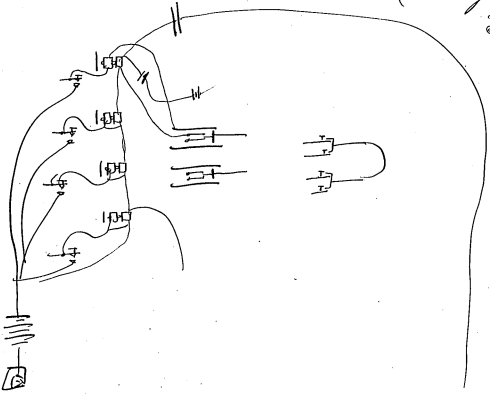
The way-station fork seems to discharge wire in middle and thus circumnavigate the law of the squares, I think it probably that the line could be put to earth after each wave small wires at several stations,



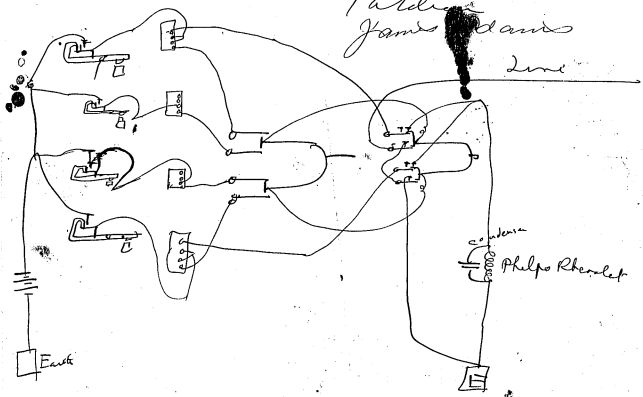
Acoustic Transfer
July 29 1874

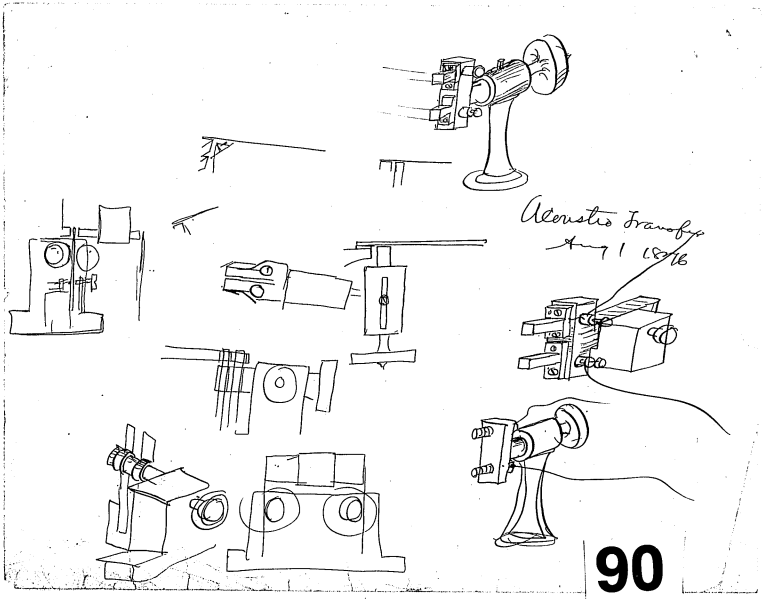


Acoustic Transformer
Aug 1 1896.
J A Fleming

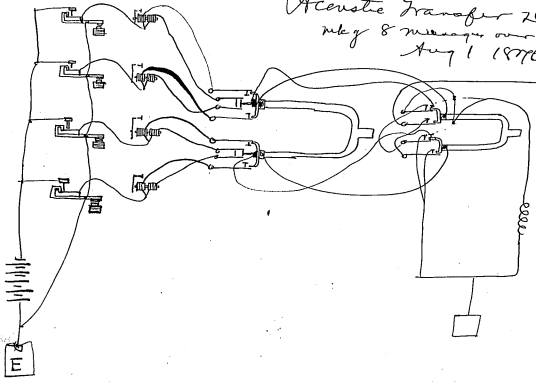


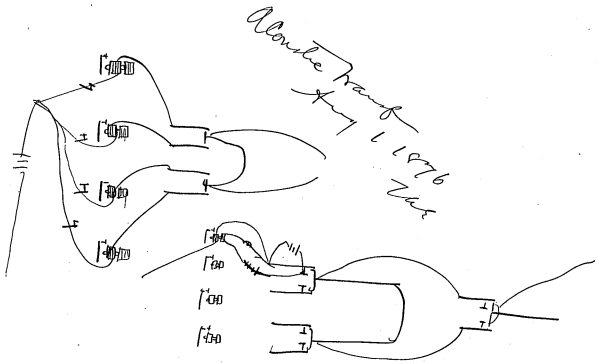
Acoustic Transmitter
Aug 1 1876
Talking
James Clark

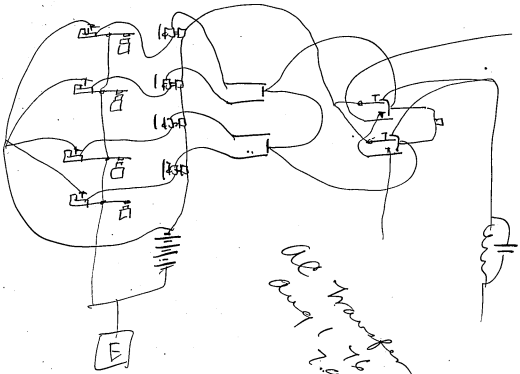



Acoustic Transducer
Aug 1 1976

Acoustic Transfer Dup
rec'd 8 messages over 1 wire
Aug 1 1876 TAT

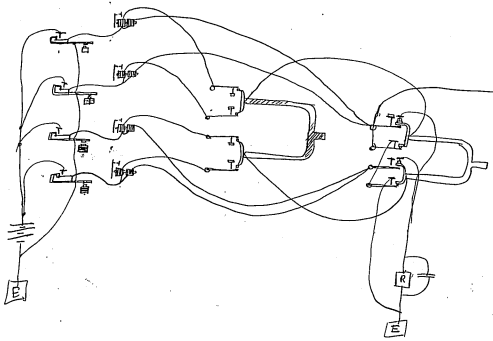



Acoustic Transf
Jan 1 1976
Zur

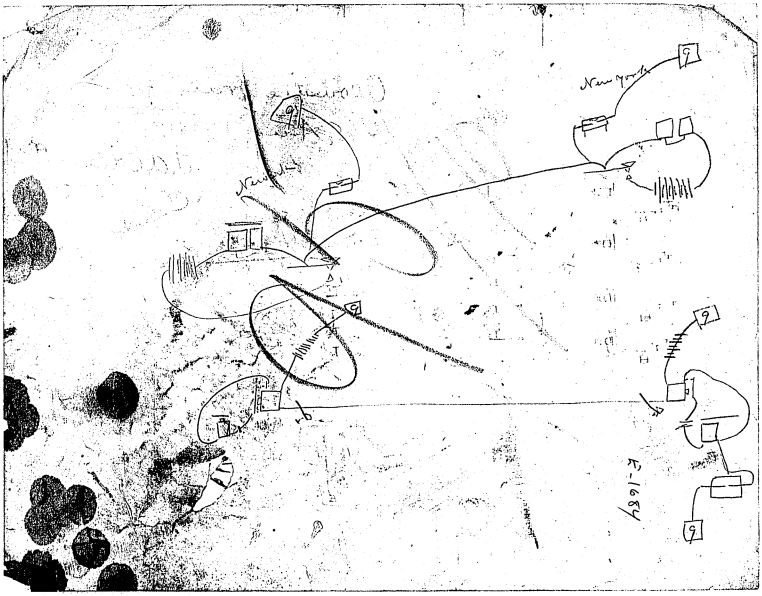

E
AC transfer
Aug 1 76
7.42

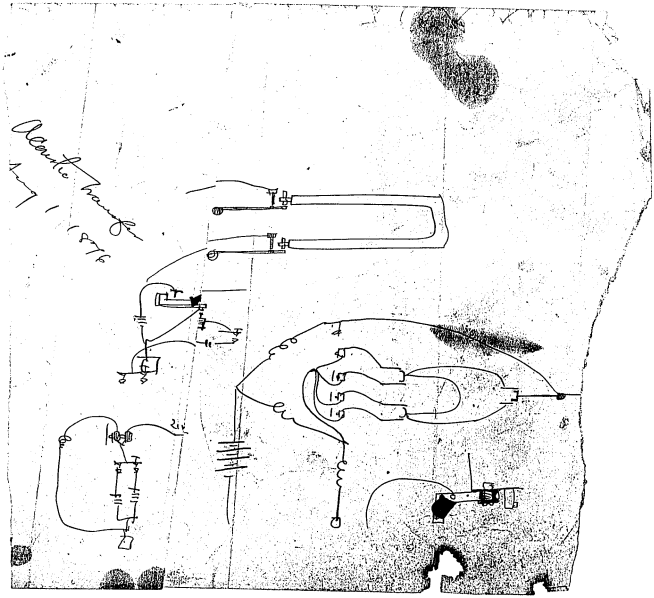
Hand Bridge
Bronx Zoo, April 1, 1876

Acoustic Transfer
Duplicate
Aug 1 1878
T. A. Edison

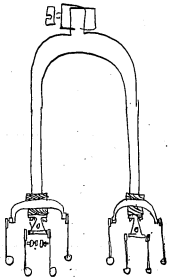


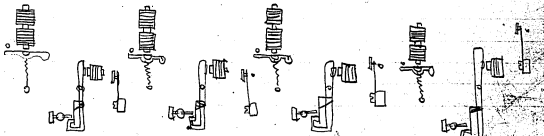
95


New York
New York
A-1689


Alexander Graham Bell
1876

Acoustic transfer
Aug 1 1898
Tait





Aug 1. 1876

392

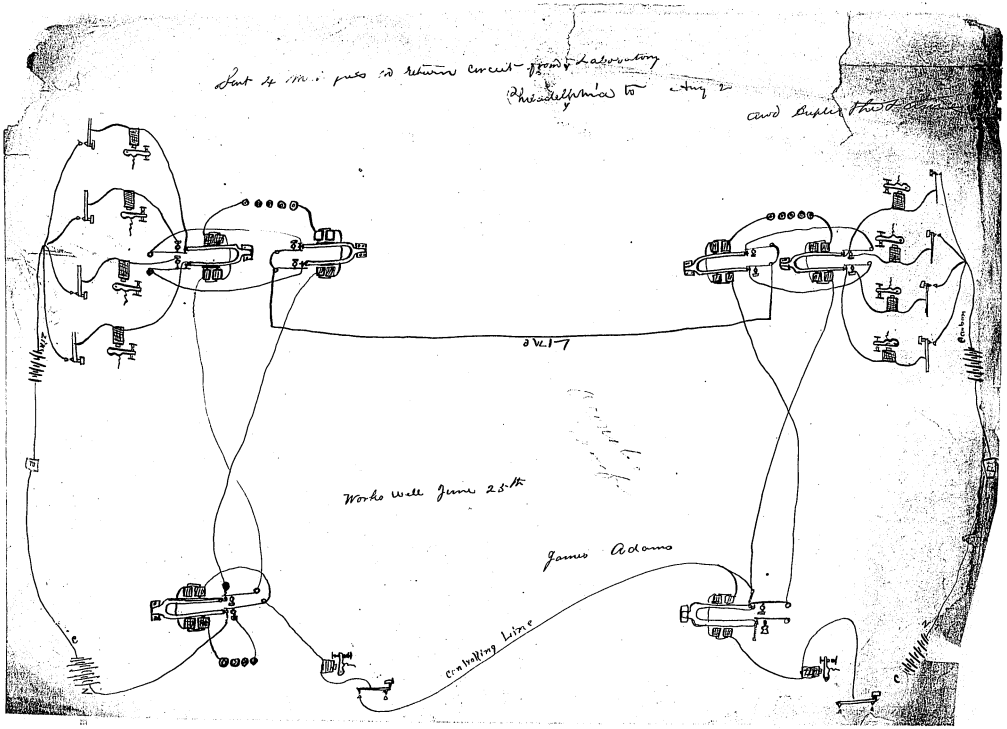
100

101/10 Genl Tel Instr Oct 8-&9

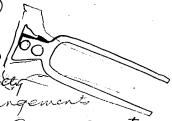
102/10 Oct 8 & 9 Genl Tel Instr

103/10 Oct 8 + 9 1880 Gen Tel Instr.

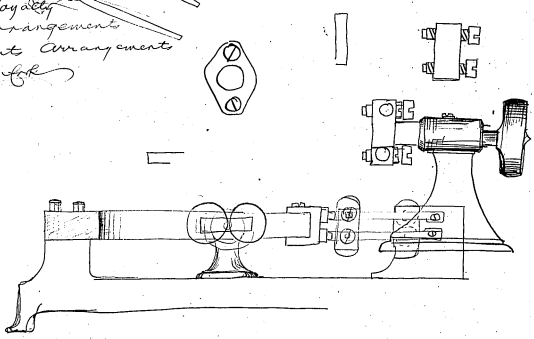
104/10 October 8 + 9 General Tel Interference


Sent 4 m.i. pole in return circuit from Laboratory
Philadelphia to city
and Duplex the
Works well June 25th
James Adams
Controlling Line

Boston
Boston
Boston Royal
Royalty Loyalty
Mutual Arrangement
Arrangement Arrangement
Arranged Fork

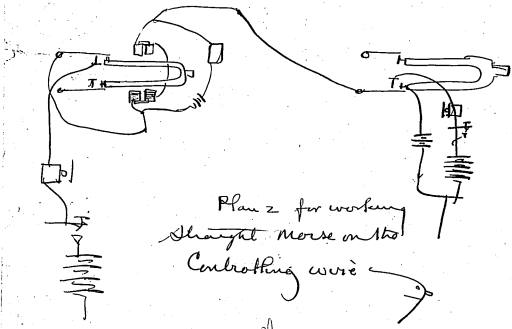


Acoustic Transfer
Aug 2 1876
T A Edison



106

Aug 6 1876

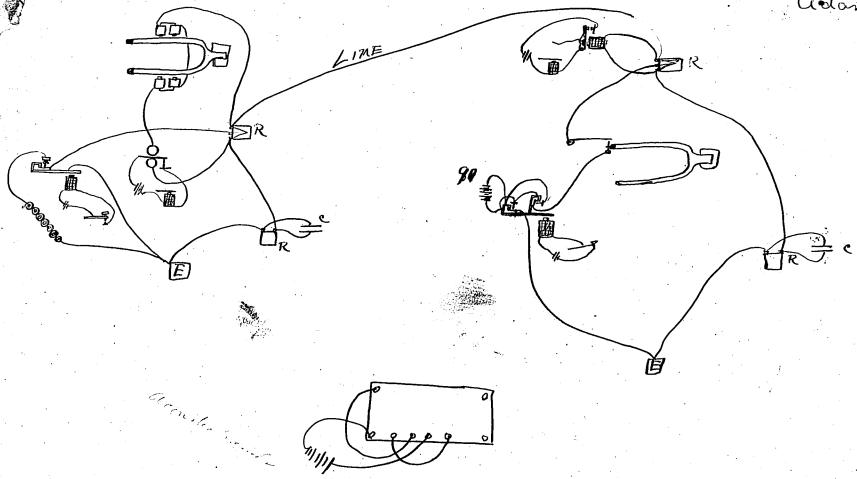


Plan 2 for working
Straight Morse on the
Controlling wire

Jany 7 '11

James Adams

Aug 6 Duplex [illegible]
line [illegible] Philadelphia
Works Bang up
Adams

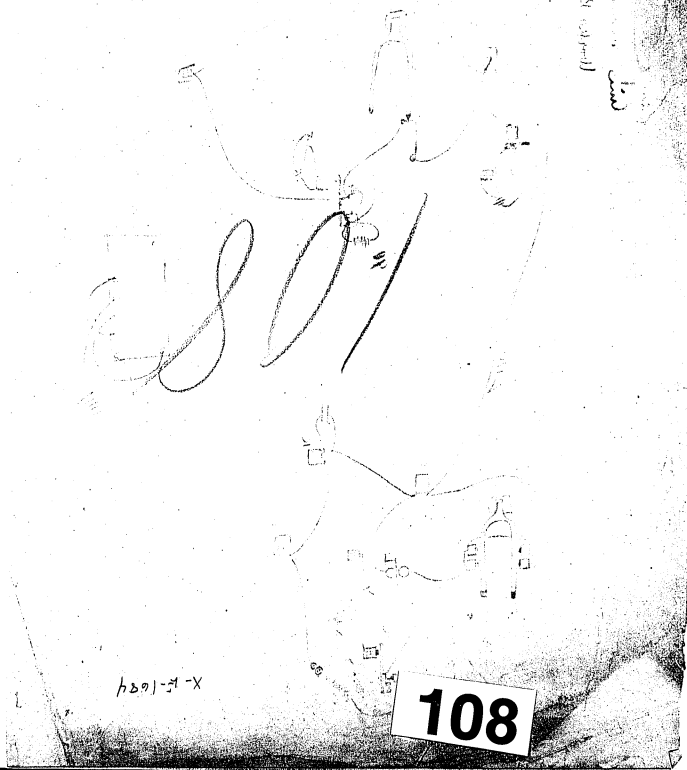


108

Reproduced 300 words per minute by Electromotograph
on a round circuit via Philadelphia 1140 Miles

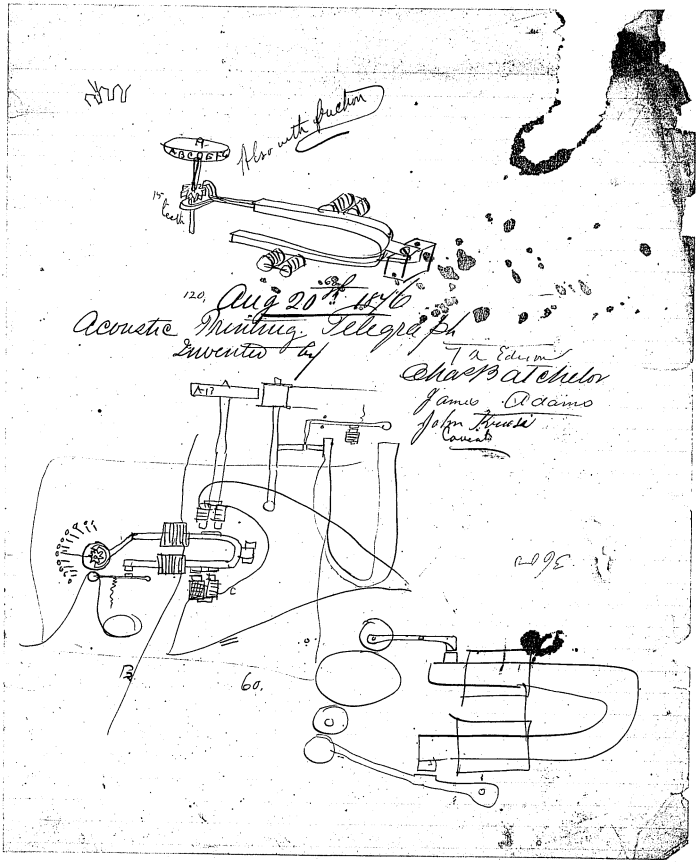
Aug 9 1876

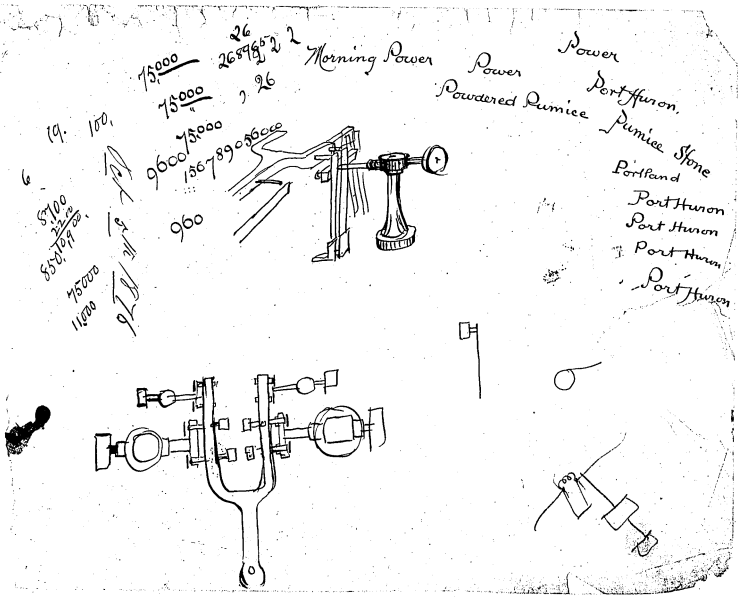
Adams



X-F-1624

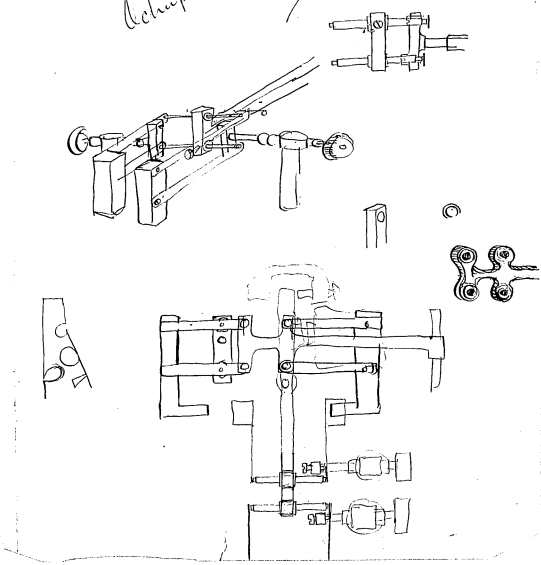
108


Flow with friction
15 Teeth
120.
Aug 20th 1876
Acoustic Printing Telegraph
Inventor
T. A. Edison
Chas Batchelor
James Adams
John Kruesi
Witness
60.


Morning Power
Power
Power
Port Huron.
Powdered Pumice
Pumice Stone
Portland
Port Huron
Port Huron
Port Huron
Port Huron

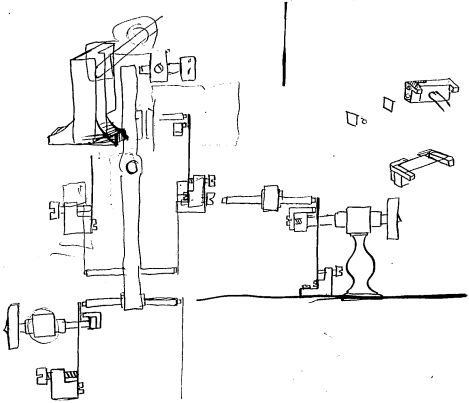
111

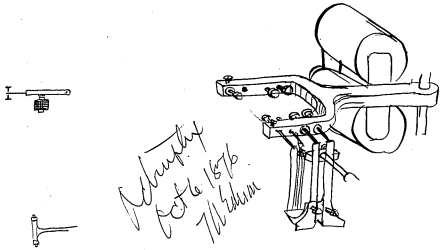
Acknowledged Oct 6 1896.
T.A. Edison

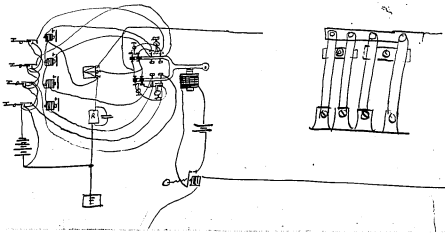


NOW IS THE WINTER OF OUR DISCONTENT

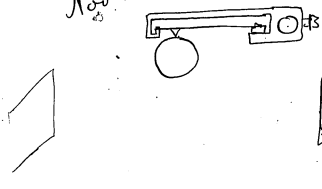
Octuplex Oct 6 1876
T. A. Edison

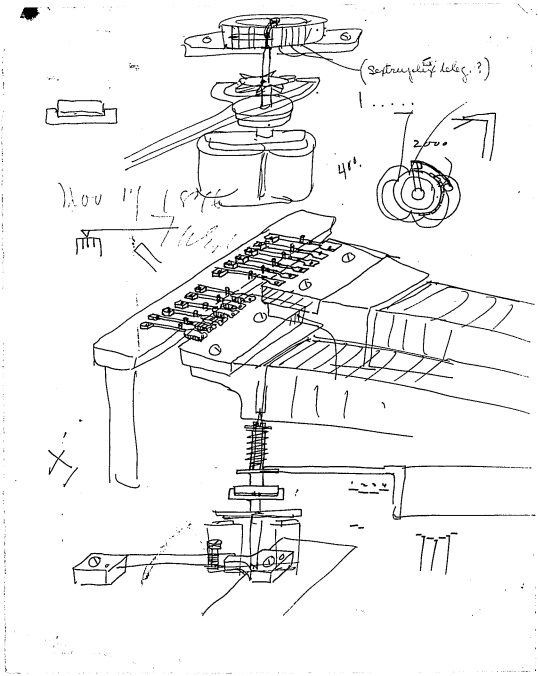






Nóż z iskierką




(Sestrojeno dle leg.?)
200
400

Notebook, Volume 11

This volume covers the period January-June 1877. The notes and drawings are by Edison, Charles Batchelor, James Adams, and John Kruesi. Most of the material relates to the speaking telegraph. There are also a few pages devoted to acoustic, multiplex, and printing telegraphy. A cover which was apparently used to bind Volume 11 together is still extant and is labeled "Old Sketches Vol 11 January to July 1877 Pages 203." The volume consists of 203 numbered, unbound leaves.

Missing pages, found in facsimile in the Telephone Interferences: 5-6, 8-10, 14-23, 25-32, 37, 39-44, 46, 48-49, 51 1/4, 51 1/2, 56, 58, 60-62, 65, 71, 76, 78, 82, 86-87, 95, 99-102, 106, 111-116, 120-121, 123, 130, 132, 134-137, 139-169, 172-173, 175-187, 189, 191-192, 195-201.

Aldershot

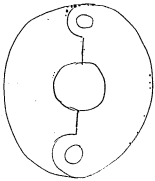
Vol. II

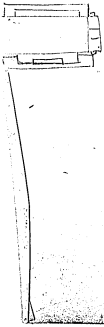
January to July 1874

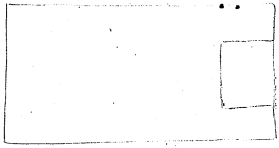
Pages 103.

E123-203

Jany 6 1877
Ia Edwin
James Adams







1

January 10. 1917.
Strong Solution Caustic
Soda in Porous pot,
with 3 or 4 Table
spoonfuls of Creosote.
SO_3 outside Strong
8½ = Shaking
Carbon goes down
Added Lillie Gallic
Acid = goes down
to 6½ = added
Carbolic no change
added Chl. Am. goes
10. 1 min 9½

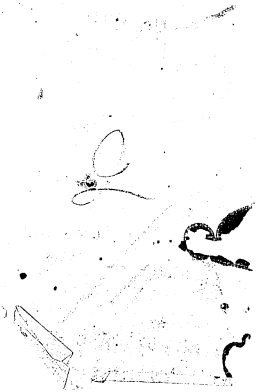
January - 10. 1917
1½ hours = Porous cell
2 Strong Caustic Potash
+ 3 or 4 Tablespoonfuls
Creosote, Sal Am
outside = strong
10 goes to 13 in 4 minutes
by Shaking Carbon
1 drop strong ammonia
goes to 13½ shaking
Carbon does not
Effect it strong
perhaps no Polarization
Ammonia stand right
Over

Very Strong
Solution of
Ammonium Chloride
in Porous pot with
7 ounces of Crystals
& Caseline Cable
Acetic outside
55, on Chloride
3 min 53,
With Mixed of Potassium Solution
— porous cell & rubber in Carbon
45 — Rubber 40

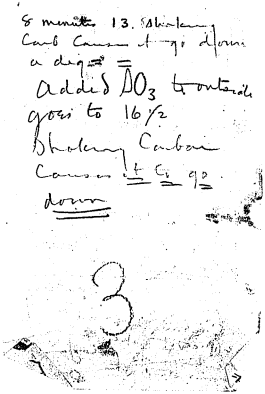
2

3

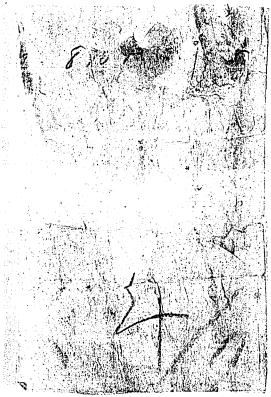
4



2


8 minutes 13. Shaking
Carb Cancer at 92 degrees
a degree =
added AO_3 temperature
goes to 16½
Shaking Carbon
Cancer at 92
down
3

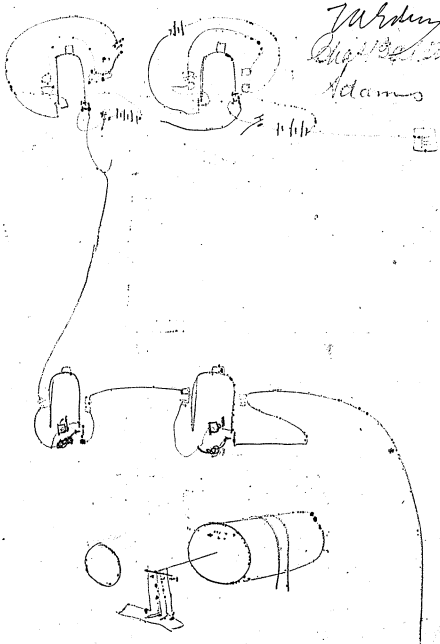
3



4

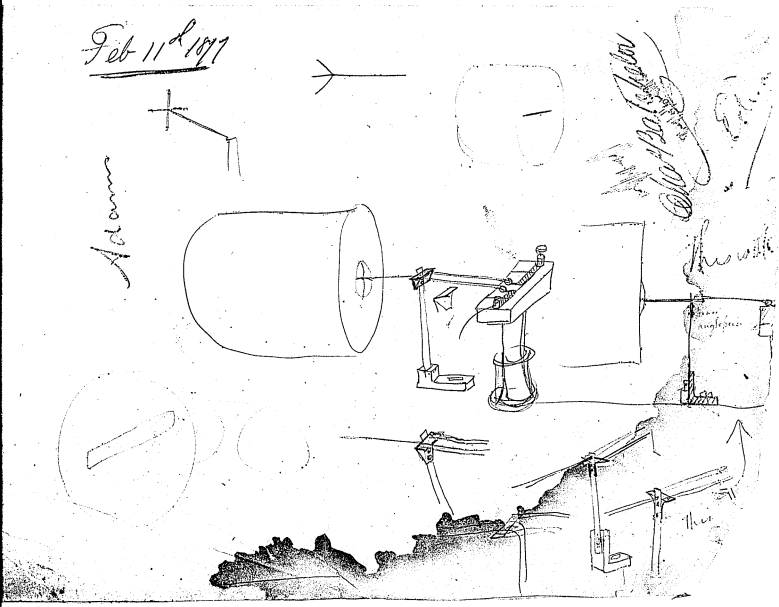
1 Feb 6 / 77

Warden
Engineer Stella
Adams



7

7


Feb 11th 1971
Adams

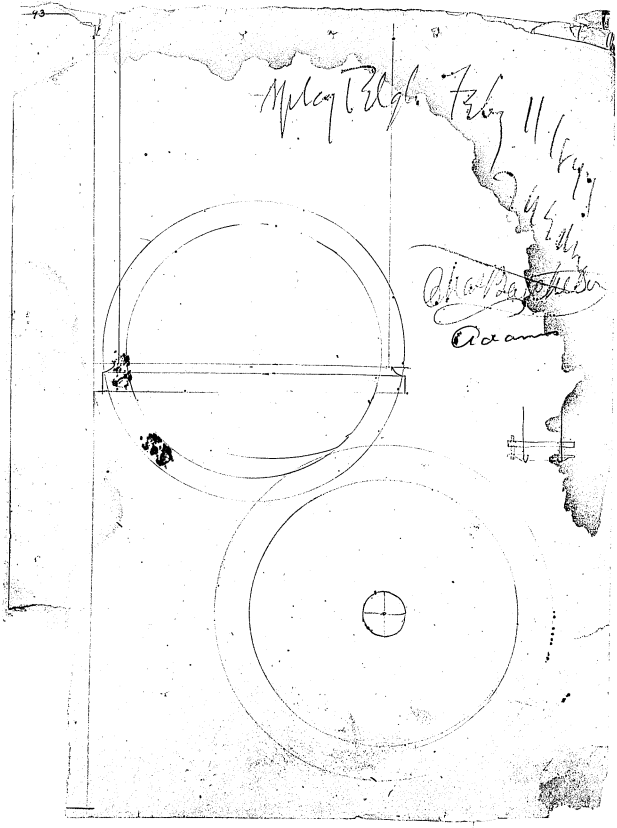
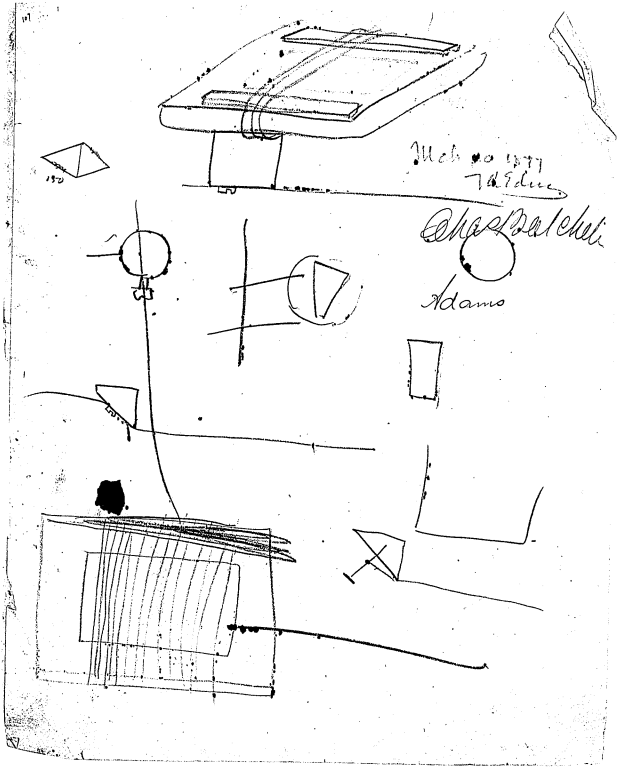


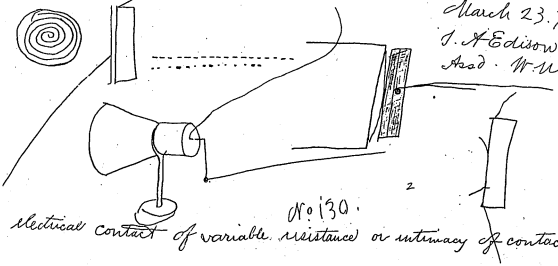
Fig 14 177


March 20 1977
Adams

This is a duplicate of the original and sketch furnished to Mr. Jewell when case 130 was ordered.

Speaking consists of sound at one rate of vibration

March 23.77
T. A. Edison
Asst. W.U.

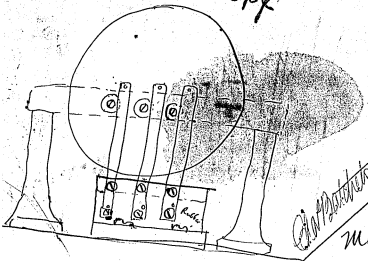


No. 130.

Electrical contact of variable resistance or intimacy of contact

28 1 2

Adams



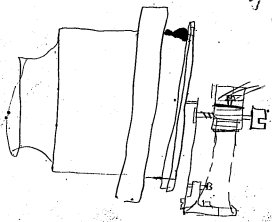
Mch 29/1877

Model Spkg Tel

33

Mch 29/77

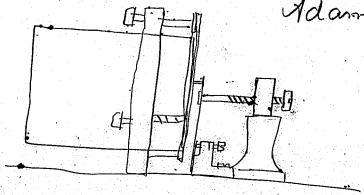
Model Spkg Tel



Adams

34

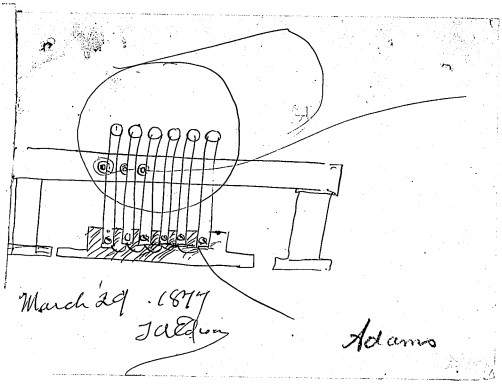
Adams



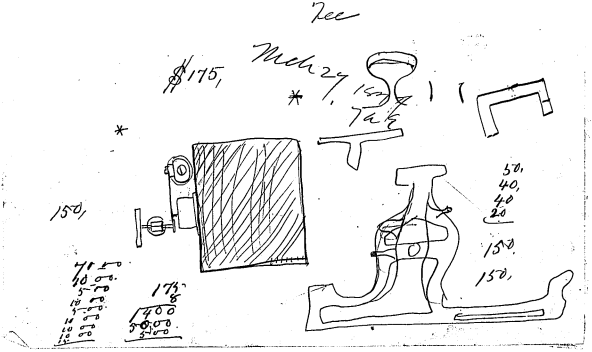
Spkg Telgh Mch 29 1877

Tel

35


March 29 1877
Adams

36

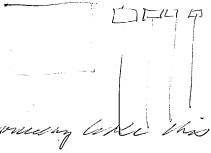

See
$175,
March 29 1877
150,
50,
40,
40
20
150
150,

38

T. A. EDISON,

Menlo Park, N. J., _____ 1880.

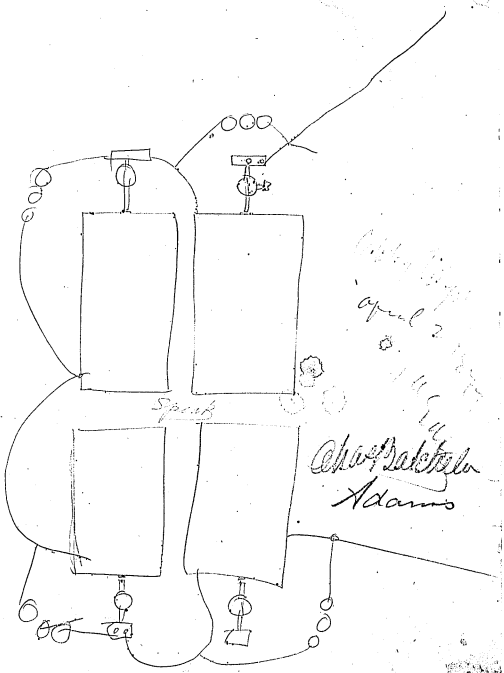
No 42 Vol. 11.
Apr. 1, 1877
Interference Chimneys



running like this

Adams

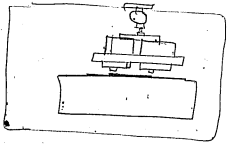
45

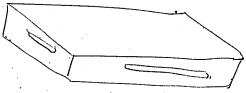

Spark
April 7
Adams

Speaking Telegh.

April 4 1877
T A Edison

James Adams
Chairs Architecture





We can get everything perfect except the hisses & hissing parts of speech such as sh" in shall - get only :o in Coach & propose in addition to the regular diaphram to have an additional diaphram adjusted very delicately to

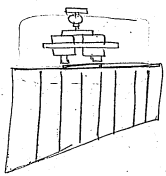
2

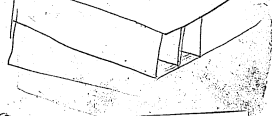
April 4 1874.
Salem

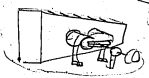
and to these hoping or choosing
Sounds. I propose that it either cut
in wind out resistance or act in the same manner
as the regular diaphram — I have just been
testing substances for imperfect contact points.
I find that great lumps of black oxide of
Manganese — Anthracite & Bituminous
Coal only give a moderate resistance somewhat
higher than plumbago. and that enormous
differences of resistance is obtained by
varying the pressure. for instance Anthracite
Coal having a resistance with light
pressure of 1700 ohms is reduced to 300
Ohms by pressure, Manganese Oxide,
from 1500 to 600, I propose to
employ these substances as carbon
points.

Chas Batchelor

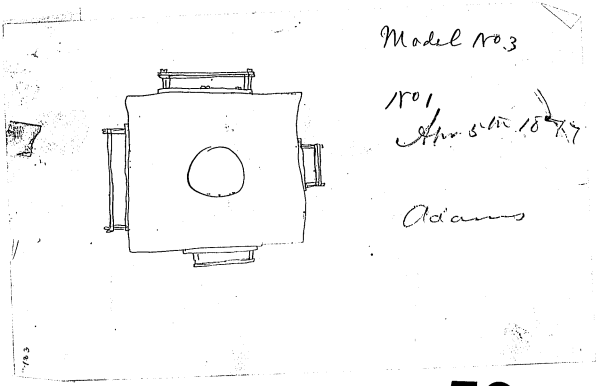
Combination agreement
Boxes in one, (No) 1 large
box & several pulleys
to surface the ground
Commencement to break
of large box



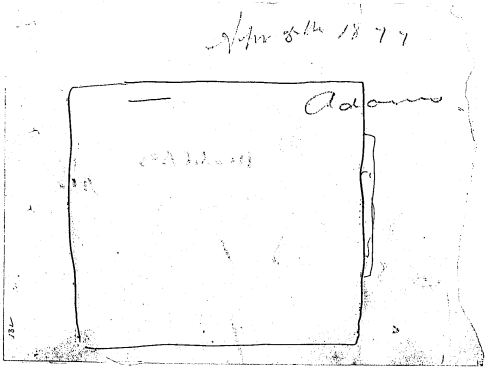




51



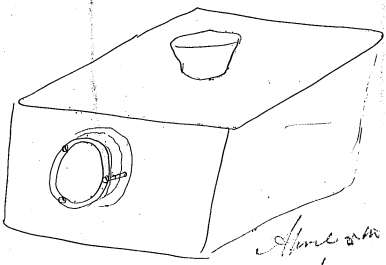
52



53

Model No 3

No 2



Filed 5th 1877

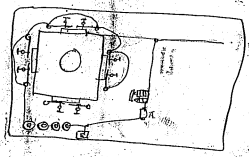
Adams

54

No 3.

Model 3.

No 4



Adams

$18. fund date April 5th 1883

55

[FACSIMILE]

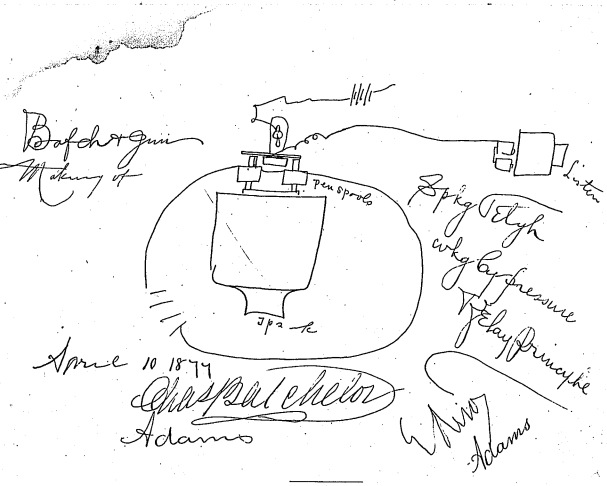
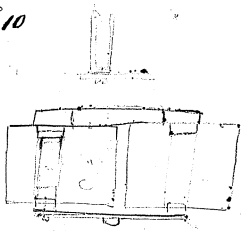


Fig. 10
189



#2,0

Delvd. Apl. 15th 1872.

Adams

59

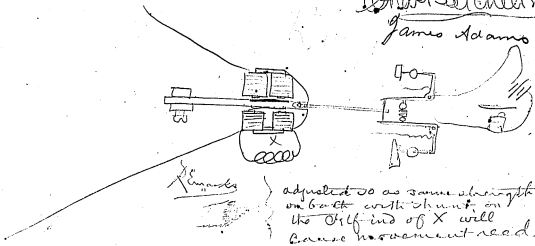
145

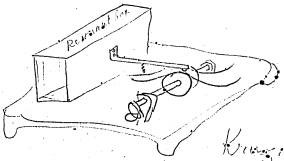
Dictaphone Ae

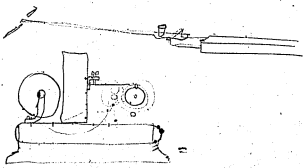
April 19 1917

T. A. Edison

Sketch taken by James Adams



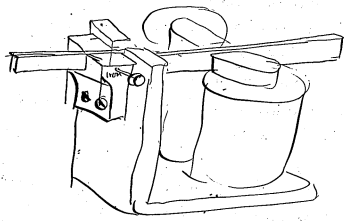




63

~~X~~ 11.

~~S~~. 2.



Delivd. April 19th 1872

Specification of Batchelor's Automatic Telegraph

To all whom it may concern—

Be it known that I Chas Batchelor of Newark in the County of Essex State of New Jersey have invented an improvement in Automatic Telegraphs of which the following is a Specification.

The object of this invention is to transmit and record Roman letters upon Chemically prepared paper over several wires at a distance, for the purpose of reporting the price of Stocks, Gold Etc.

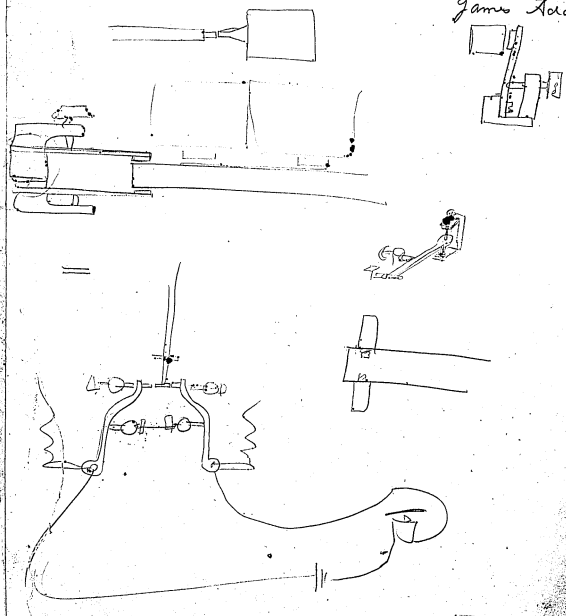
The invention consists in the combination of a roller for giving motion to the chemically prepared paper with a number of recording points, wires, styluses and a number of polarized Relays placed in the various circuits the tongues of which connect and disconnect the current from a

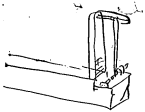
Quadruplex &c.

April 9 1879

T. A. Edison

James Adams





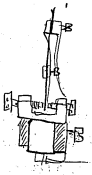


Fig 2.

Fig 3.

Dated April 19th 1872.

67

local battery with the recording
parts.
It further consists in the arrangement
of apparatus for forming the letters and
figures

April 19 1881. 6p

Ruzi

Of the Cwm or Gorseinon & Llanelli
Co Cop in Cotton =

For Refined $12

for Centuries .1 50/100

Wm. H. Dobson April 25th 1877

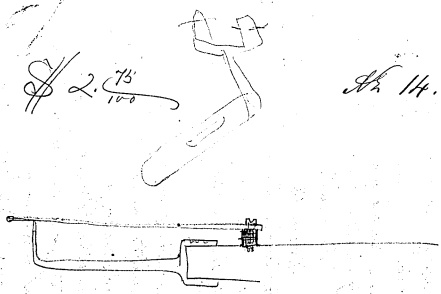
68

Chemically
paper upon which the char
are to be recorded by chemical
decomposition This drum
is rotated by clockwork
and constructed in the usual
manner with the exception that

67

$2.\frac{75}{100}$

No. 14.



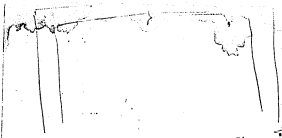
Delivered Apl. 19th 1892

rotated by hand or any suitable source of power.

I remark that the polarized Relays might be dispensed with and the recording done direct from the batteries ——— if the proper styluses were used to mark with positive & negative currents. Derived circuits to the Earth from the main lines may be used for taking more than one copy of the message if the battery power is sufficient.

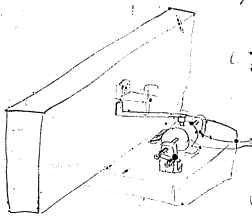
If the chemical paper is dispensed with and the levers of the polarized Relays moved together over the drum ——— provided with ink wheels inked by an Inking disk or in any suitable manner the record can be in ink instead of the levers claving

DD



E. M. G. Speaking Telegh Room —

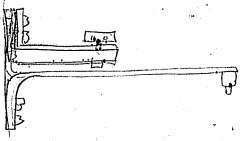
April 17 1877.



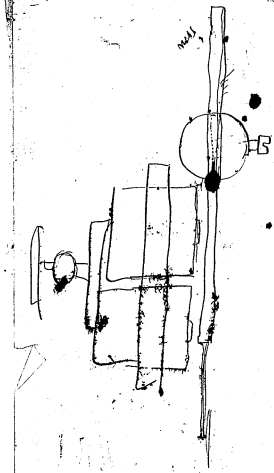
Adams

$8.00

about 15 inches long



No. 19 Dated April 28th 1877

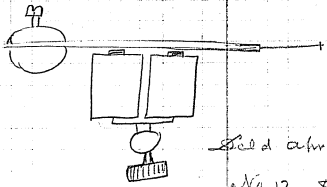


#2.

#12.

Solved. August 19th 1871

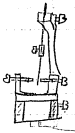
Adams



Filed Apr 19th 1877

No 12 $2 00

Adams



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Apr 19th 1877

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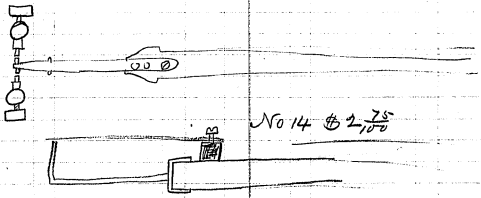
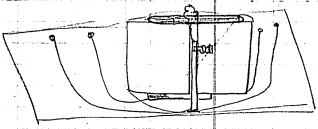


No 14 $2 75/100

Apr 19th 1877

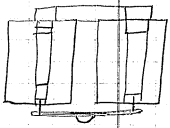
Adams

73



Delivered Apr 16th 1877
No 9 $1.00

Adams



$2 00

No 10 April 16th 1877

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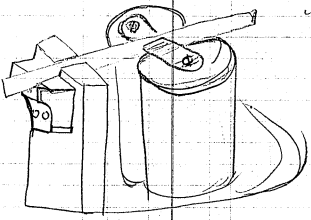

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Delivered Apr 19th 1877

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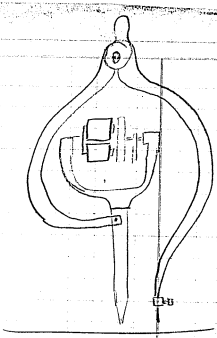

No 15" # 6

Apr 20d 1877

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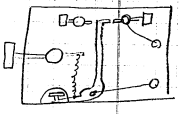
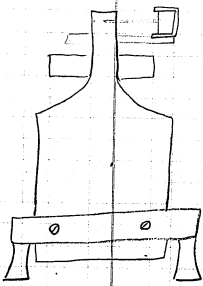




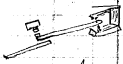
No 16

Apr 23d 1877

Adams

$10 00

No 17 Apr 25th 1877



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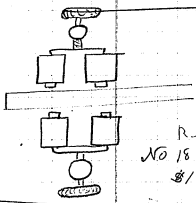
$1 60/100



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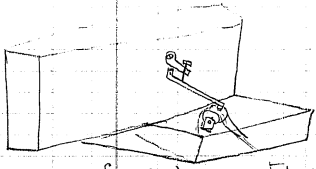
No 18 Apr 25th 1877
$1 25/100



Eon 9. Speaking Telegraph

$8 0/100

No 19 Apr 25th 1877

Wm. Spring Bedge

April 19 1877

Chas. Satterlee
James Adams

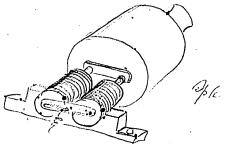


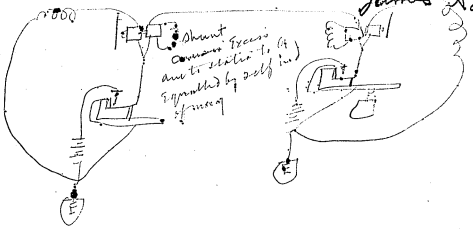
Fig. 1

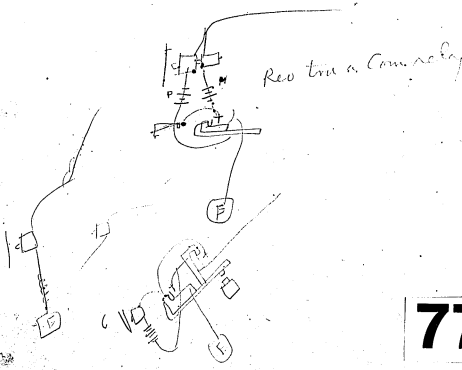
75

Static discharge & charger on
Dynaplex & Omnio

April 20 1899
J A Edison

James Adams



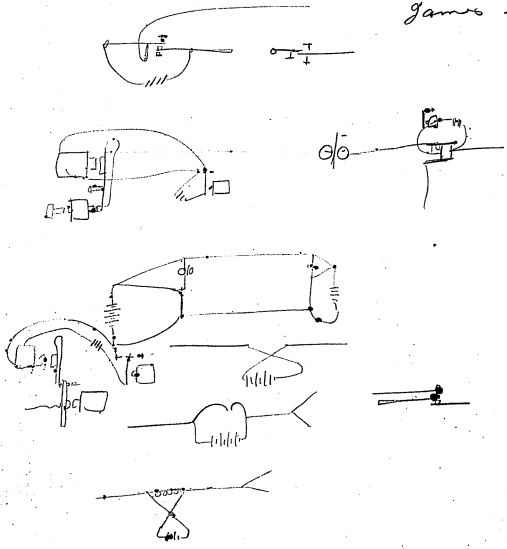


Rec tru a. Commutator

77

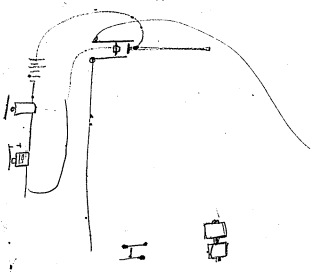
April 23. 1877.
T. A. Edison

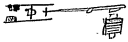
James Adams



79

April 23 - 1891
T. A. Edison





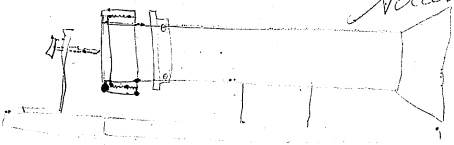
80

Mr. Spielmann 1/77

Edison

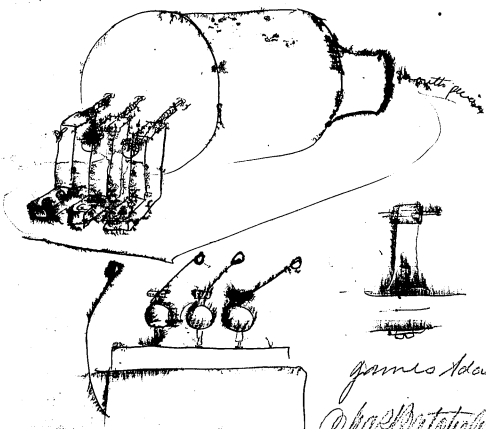
~~Charles Batchelor~~

Adams



No 3

Fig 7

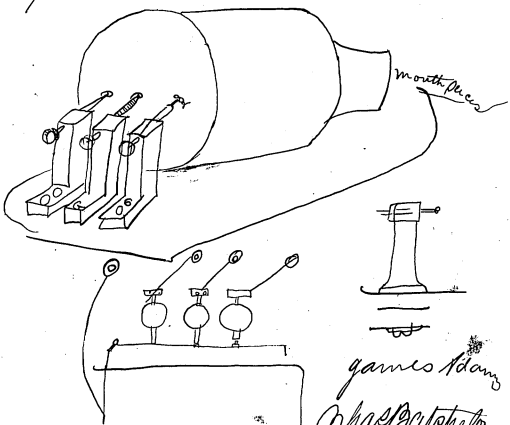


83

[TRACING]

No 23 Delvd May 3d 1877.

S/7



James Adams

Chas Batchelor

Krugi Spkg Tel May 3 1877

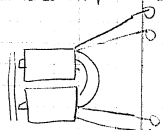
7a Edcc or

84

$6

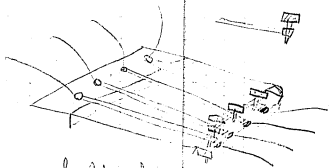
84

wind both. The top reels differ. not
place with old top the same as the [illegible]



$6 00/100

May 8th
No 25

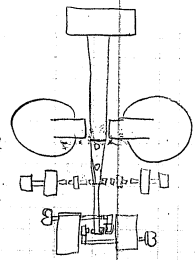


Self bender

May 11th 1877

$10 00/100

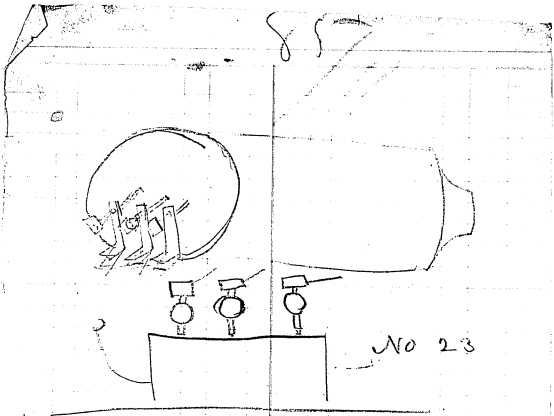
No 26



No 27
Detupler

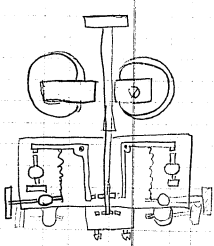
May 13th 1877

$7 00/100



Spacing the [illegible]

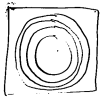
$7 00/100



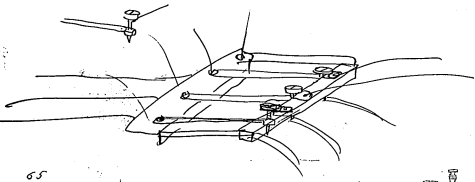
No 24
May 7th

$10 00/100

Selwether



$10,



55

Self Bender.

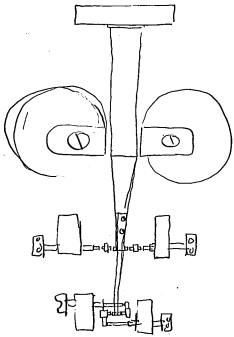
No. 27 Dated May 13th 1877.

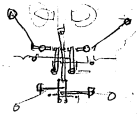
Sertuplex

May 11 1877

J. L. Sidney

No. 7.





89

Speaking Telegraph

May 18 1847

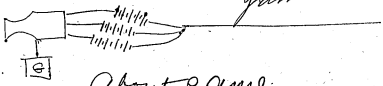
T A EDISON

Chas Batchelor

James Adams

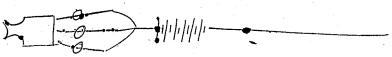
Pocket Relay

Try -



About same

Try



About same

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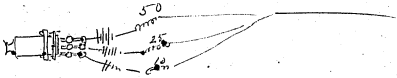
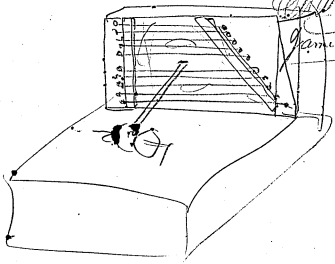


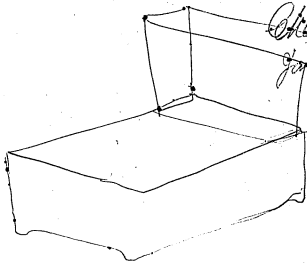
Spley Tedy

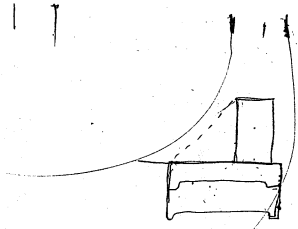
May 18 1877
Spley Tedy
Ta Ed.
Chas Bolcher
James Adams



Topley Tzlgh

May 18 1977
7 a Edi
Otra Palchata
James Adams





When shall we three meet again

ren shall we three meet again

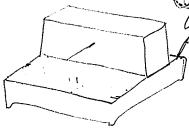
Witness [illegible]

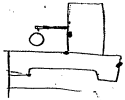
May 19 1877

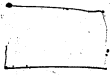
J. W. Eden

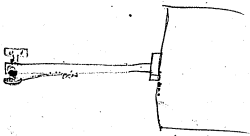
Oliver Batchelor

James Adams



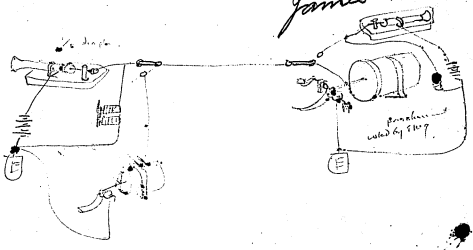


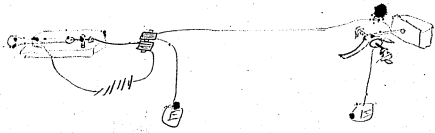


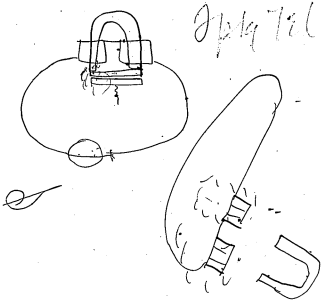


Spring Edge

May 19 1877
J A Sirlin
Chas Dalgleish
James Adams







Aug 21
77

Edwin
Charles Patchett
James Adams

Telephone

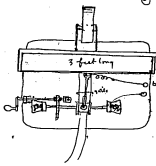
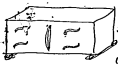
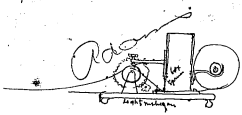


fig 4

May 24 1877
T A Edison



with bridge in
center where Bung does
in fastened.



gear 8 to 1 or thereabouts even
10 to 1 or 3 to 1 would

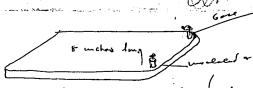
Base Light Mahogany inch stock rounded edges

also = round legs 1/2 inch high thus

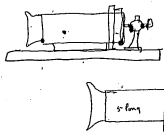
168

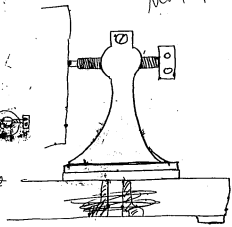
Transmitter for Telephone

Charles Adams

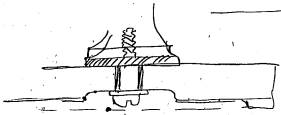


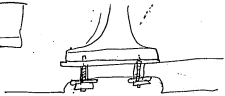
May 24 1877
Charles Adams





Use gear fly wheel
tube =





98

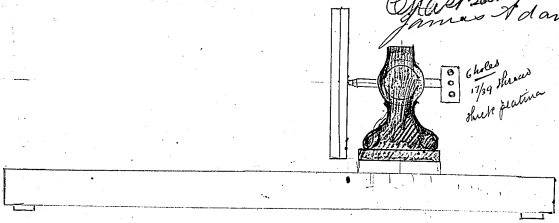
May 30, 1877

9/11

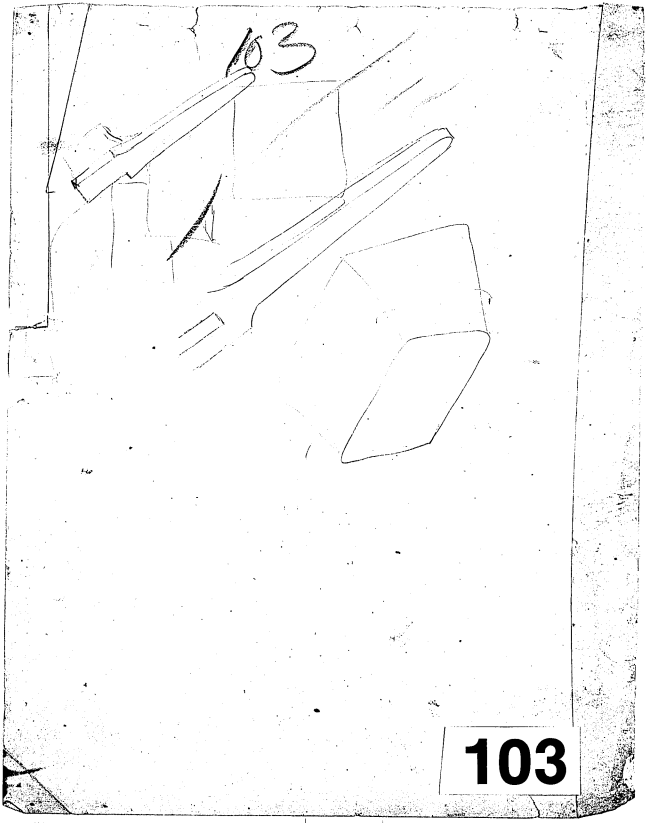
Wake Oct-30-1880

Singing Telegraph

Mar 25 1877
Edison
Graebakkeb
James Adams

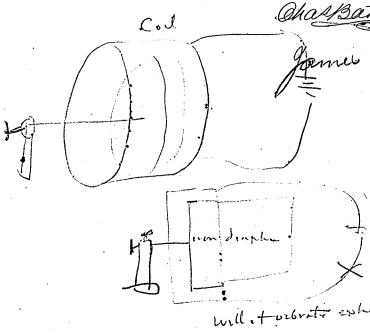


103


103

Spling Blgs

May 26 1877
T A Edison
Chas Batchelor
James Adams



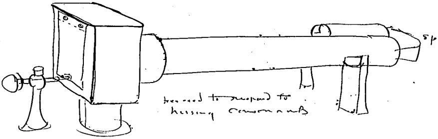
pp 221 = 9

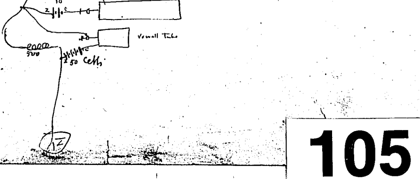
104

182

Speaking Telegraph 105

May 26 1877
T A Edison
Chas Batchelor
James Adams





T. A. EDISON,

Menlo Park, N. J., ... 1880.

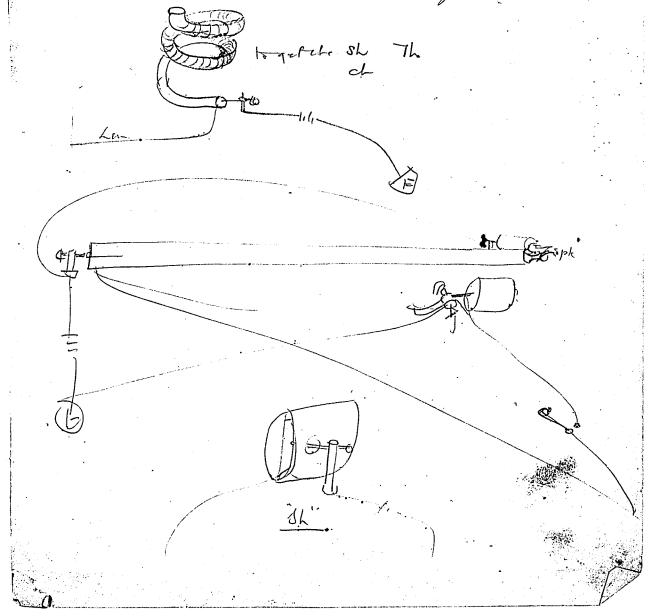
No 106 Vol. 11.
May 26. 1877

Chemical Intelligence

Speg Telegraph

May 26 1877

Witness
Chas Batchelor
James Adams

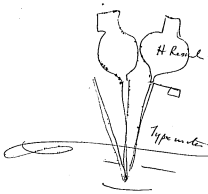


Speaking Tube which prints automatically the speech

May 26 1877

Edison

Chas Batchelor



Each Resonator is tuned to respond to any particular string & may be assigned to open & close an Electric Current & thus control the type-writer or that may be touched together as chemical recording points

Many resonators on these passing on open the resonators will control which Pencil prints the letters = Bar Ritter suggests strings at same work – power of sequent Mylar & Phonograph = N.G.

108

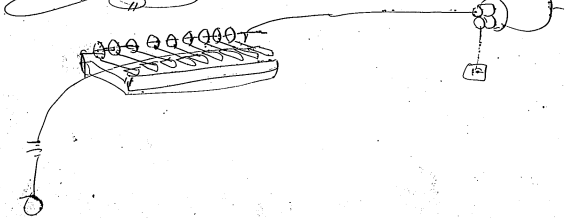
177

Keyboard Talking Telgh

May 26 1877

Chas Batchelor

I propose to have a long shaft with wheel on having breaks (electrical) so arranged with a keyboard that by depressing say the letter T H I S simultaneously that control springs will one after another and the proper vibration over the wire to cause the Ency & diaphram to speak plainly the word this: by this means no difficulty will be had in obtaining the missing consonants. and as the breaks wheels & control springs may be arranged in any form and as many as required and the overtones harmonics & other parts of speech can easily be obtained ~~from the same as you used for E & hoop~~ strip



175

Talking Telegraph

May 26 1877.

J. C. Bacon

~~Chas Batchelor~~

James Adams

I find that it is absolutely essential to perfect the speaking telegraph that the sh sh ch s and other hissing sounds should be sent over the wire, now the diaphrams we have made do not respond to an appreciable extent to this hissing sounds = Now I think these hissing sounds are compound of vibrations and are notes bearing an exceedingly low rate of vibration ~~ably~~ 10 per second &c. weak of tail, Now I propose to construct a tube & diaphram which will respond to them and this tube I propose to have made like a telescope so I can increase or decrease its length so as to get a length of tube which will be in tune with these hissing & reinforce them and I propose to have this tube adjusted not to reinforce the hissing there being no trouble in getting the higher rates of vibration without the assistance of the column of air = I fancy the higher rates can be made on another tube & diaphram The Tacker talks into both tubes at once & both serve to close the tackling =

110

T. A. EDISON,

Menlo Park, N. J., ... 1880.

No 112. Vol 11.
May 31/77
Interference Shimack

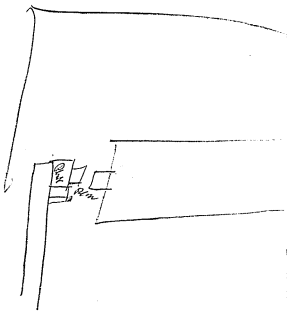
weights on evacuator

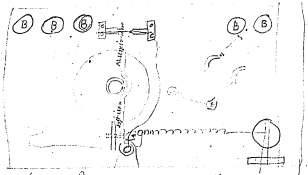
T. A. EDISON,

Menlo Park, N. J., ... 1880.

112—11

May 31. 77





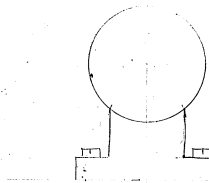
117

Speaking Telegraph June 5

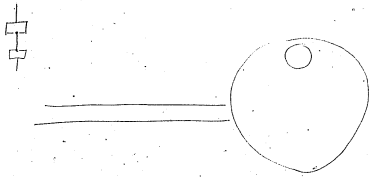
Edison

Charles Batchelor

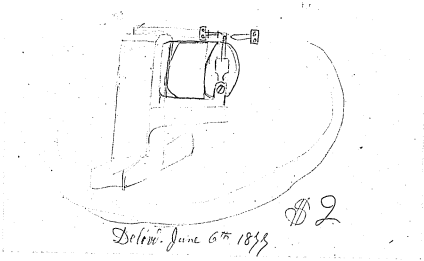
James Adams



Support for tube at end.
3/4 or 7/8 thick



118



119

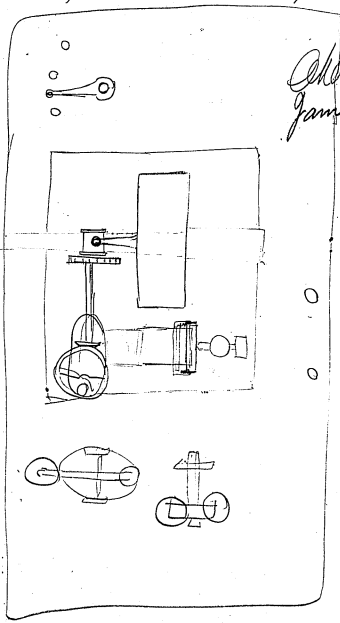
D/1/64 Fol

June 7 1884

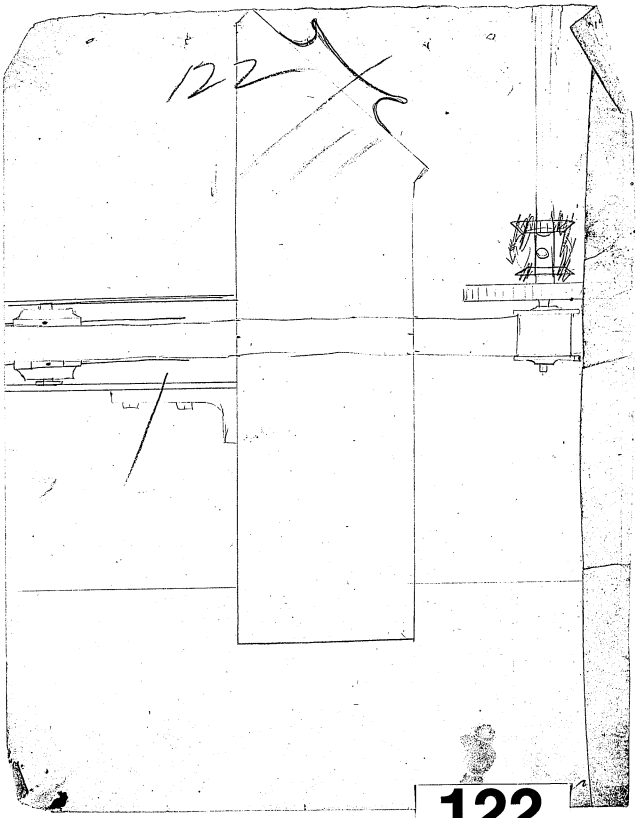
Edison

Chas Batchelor

James Adams



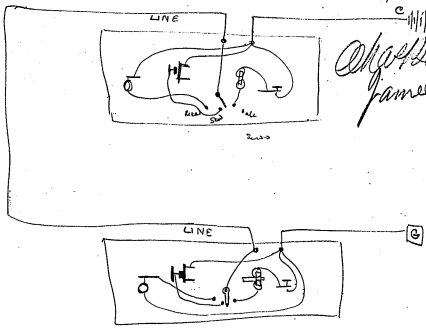
122


122

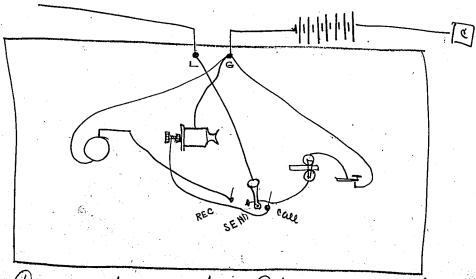
195 Talking-telegraph

June 7th 1877

J. W. Edwards



Chas. Sherman
James Adams



Connections for Speaking telegraph

1 Pattern for tube stand
" for adjusting chele
" for adjusting post
" Vapour Tube Stand
Hinge
Fig. 1
Fig. 2
June 7th 1874
Reisans
9/16

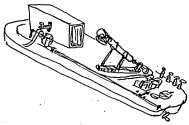
194

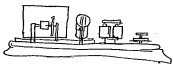
June 7 1877

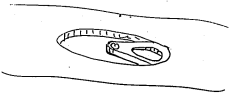
T A Edison

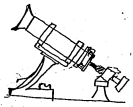
Chas Batchelor

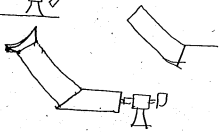
James Adams











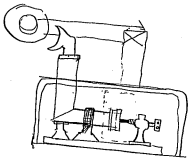
Speaking Telegraph

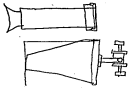
June 7 1877.

T. A. Edison

Witnesses

James Adams



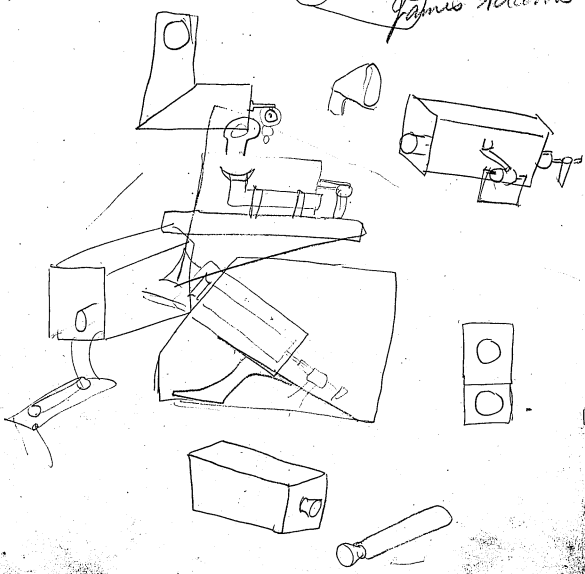


I think that with the plumbago from gauntlet the diaphragm ought to be smooth with platina.

[illegible]

June 7 1897
T. A. Edison

Chemical Detector
James Adams.

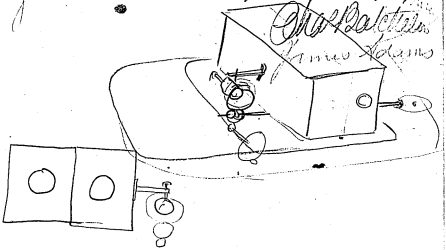


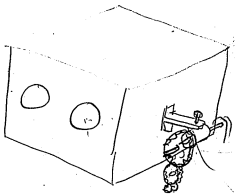
199

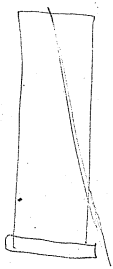
Spicy Tsleigh

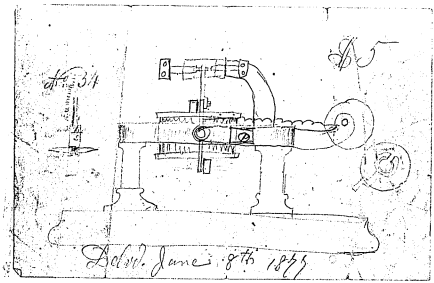
Jun 7 1877
745

Chas Baltzer
James Adams

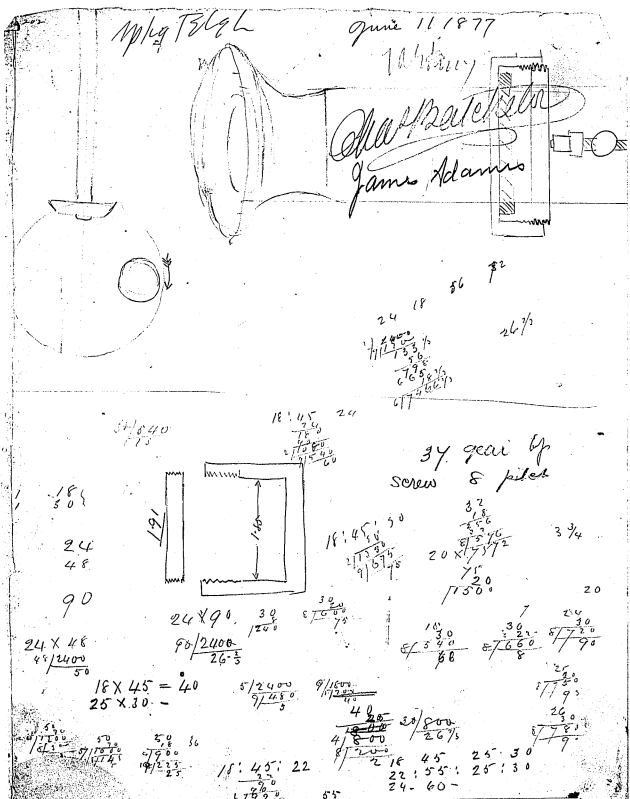








131


Mfg Tool
June 11 1877
James Adams
37 gear Up
screw & pilot
18 X 45 = 40
25 X 30 =
18 : 45 : 22
18 : 45 : 25 : 30
22 : 55 : 25 : 30
24 - 60 -

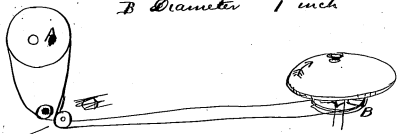
133

207 Speaking Telegraph

June 14th 1877
Edison
Chas Batchelor

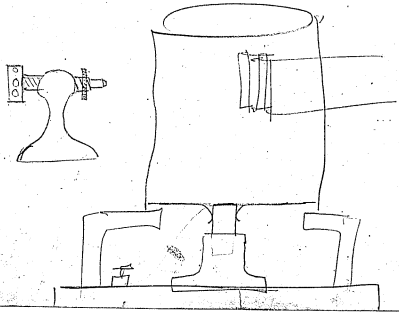
Motion for driving paper feed James Adams

A Diameter 3½ inches
B Diameter 1 inch



Winding pulleys

Use round belt ⅛ inch and groove pulleys so



138

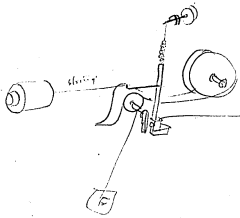
241 Talking Tel

June 21 1877

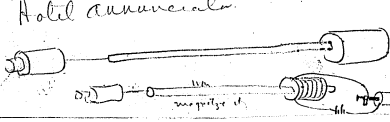
T A Edison

Chas Batchelor

James Adams



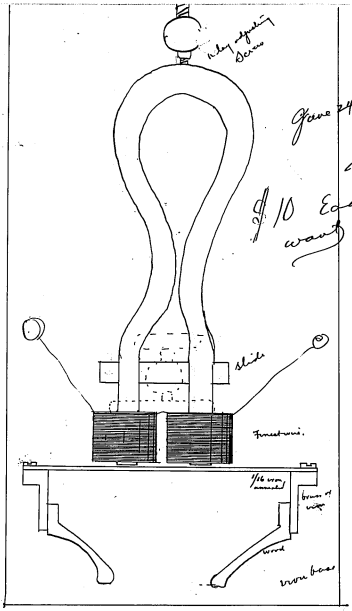
Hotel annunciator



170

Fig. 29

Galvanic Chain Belts



June 24 1877
J. A. Lewis

$10 Each
wanted 2 often

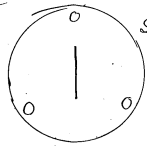
One made without steel magnet of soft iron
Cost

171

Speaking Telegraph June 24 1877

Chas Batchelor
James Adams

In our speaking instrument we cut a slot in the diaphragm thus:— in order to get the low as 'sh', 'th', and others



Sounds such

This as far as a failure

During the night we could not get anything on ordinary plumbago we used before but about 4 A.M. we got it right by altering a wore and making a new plumbago We thought from this that the composition must have deteriorated but we cannot tell until we have investigate

These experiments are unreliable

Batchelor

261

Spring Field

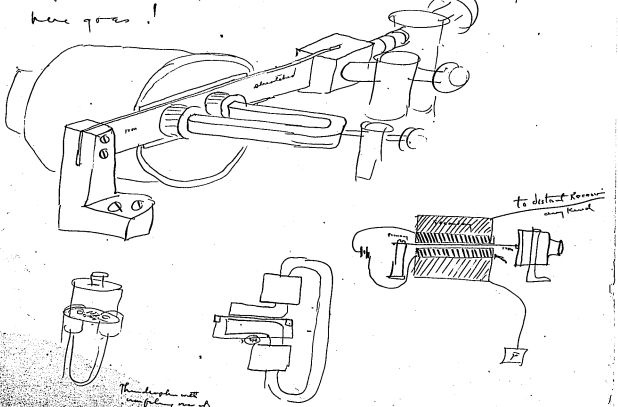
June 26 1877

Dear Sir

Could get it ordinary conversation fair but not so good as ours, Reading out of a newspaper something strange & unknown Cheaduit Catch a word in half Column whereas with our you could get the general tenor of every thing that is recit =

James Adams

I propose to improve Bills as well as my own here goes !

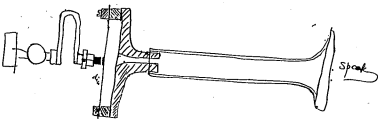


Speaking Telegraph

June 26 1877.

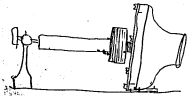
Collodion film for a diaphram = Mica for diff

James Adams



Having a small hole the amplitude of the vibration of the hearing diaphragm are increased whereas the volume of sounds are diminished which improves the articulation -

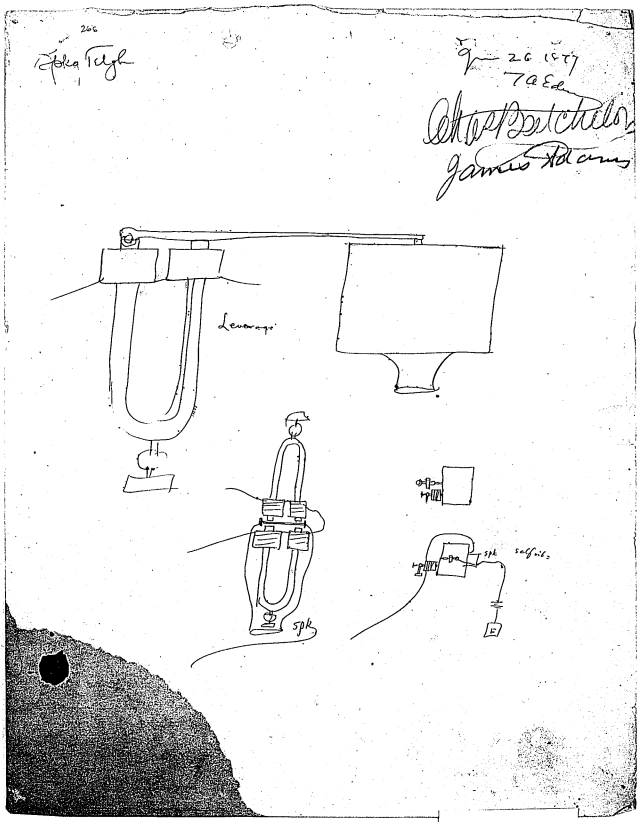
Just finished a Bell Magneto Telephone -



1/16 iron diaphram resistance magnet 250 ohm 1 inch long fork permanent magnet about 7 inches length lifts about 2 lbs iron I find that diaphram dont seem to vibrate but the Case diaphram & all does & it is this that does the work & I believe this is the way Bell is fooled by Bourseul his speaking device is idiotic =

Conversation with the pair. It was a long, I consider it be — but Batch & Gain By paying good

190


Levers
spk
spk
E

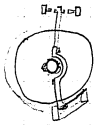
Edison's Embossing Telegraph June 26th 1877

Chas. Batchelor
James Adam

Edison noticed a serious error in Embosser at Murrays today that is that the repeating point following close behind the embossing point and being in the same straight line from centre of swing lever will not ~~[illegible]~~ ~~in the~~ exactly the marks made by embossing point. This we remedied by making the two points only $\frac{1}{10}$ of an inch apart thus decreasing the error so as to make it hardly perceptible.

May 30th Telephon with 3 transmitters
80 hours

June 3
Tather cast 3 Bell transmitters
36 hours



June 6 1875 7 00 No 32

May 24th	Started at 11 a.m	H.10
" 25		15
26		10
27		10
28		14
29		21
		80

May 31	Talking	Telegraph		10 hours
June 1	"	"		13
" 2	"	"		10
" 3				3
				36

Allowing Automatic Relay $2 50/100

No 33

202

Sec 17 1/11

May 19 Electromotograph for Sextuplex 18 00/100

No 28

May 23 Electromotograph for Telephone 15 00/100

No 29

June 15th Angle Spool Relay for Sextuplex

8 00/100

No 34

Speaking telegraph Model for Murray
transmitter & Receiver

No 35

June 8th		hours	8
"	9	"	9
"	10	"	12
"	11	"	14
"	12	"	17
"	13		5
"	14		15
"	15		15
"	16		9
"	18		14
			118

202

June 21 No 36.

Firing Chesel for tin foil glass on Electrical Pen

$2.$ $\frac{50}{100}$

June 22 Electric Pen for Music No 37

$3 $ $\frac{50}{100}$

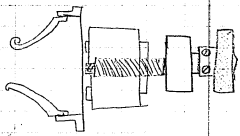
June 22 Front Points for Double Relay No 38

75c

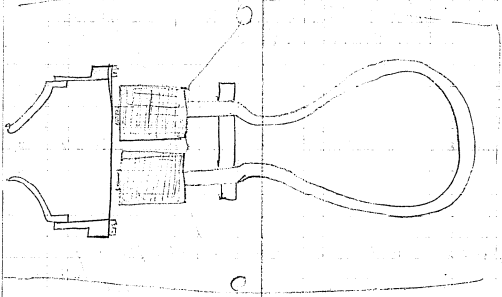
June 24th Diaphrams for Talker No. 39

50c

June 30th No. 40



Bell Telephone with magnets $10.00



2 Bell Telephones No. 41 $10 Each
June 30th

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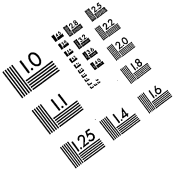

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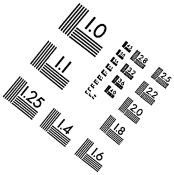

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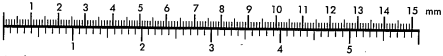
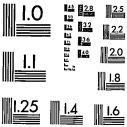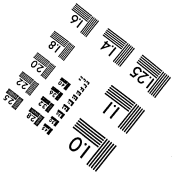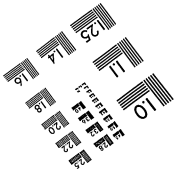
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